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# Using organizational systems theory to improve Defense Acquisition and warfighter requirements

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# NAVAL POSTGRADUATE SCHOOL

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## MBA PROFESSIONAL REPORT

**Using Organizational Systems Theory to Improve Defense Acquisition and Warfighter Requirements**

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**December 2007**

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**USING ORGANIZATIONAL SYSTEMS THEORY TO IMPROVE DEFENSE ACQUISITION AND WARFIGHTER REQUIREMENTS**

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Submitted in partial fulfillment of the requirements for the degree of

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# USING ORGANIZATIONAL SYSTEMS THEORY TO IMPROVE DEFENSE ACQUISITION AND WARFIGHTER REQUIREMENTS

## ABSTRACT

It is well documented that the Defense Acquisition System has habitually fallen short of providing timely, cost-cognizant procurements in support of America's warfighter requirements. Hence, this MBA study employed a systems approach to more credibly pinpoint improvement areas in the Defense Acquisition System through the use of systems theory and an organizational systems model as foundational analytical tools. The results of this analysis identified system incongruencies with success factors, system direction, learning, input variability, and task differentiation, which are likely sources of common, ill-conceived outcomes of the Defense Acquisition System. This analysis, through its recommendations, also laid groundwork for future, solution-oriented studies of how to suitably design Defense Acquisition System processes and structure strategies in support of warfighter needs.

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# I. INTRODUCTION

## A. OVERVIEW

The Department of Defense (DoD) Acquisition System is part of a complex machine bureaucracy often criticized for failing to rapidly meet the needs of warfighters in a myriad of operational realms.[1] For example, the Missile Defense Agency conducts testing of its Ballistic Missile Defense System with the intended outcome of defending the United States from external missile attack. Each missile test requires hundreds of trained personnel, coordination among geographically dispersed agencies and commands, target vehicles, interceptors, a plethora of sensors, dedicated airspace, and command and control oversight. All of these human and mechanical assets, parts, and pieces interact with the unified purpose of shooting-down (disrupting) incoming (ballistic) missiles.

Despite considerable resources and some success, it is generally regarded that overall missile defense performance is well-short of the vision promulgated by former President Reagan in the early 1980s. One reality is that the missile defense shield in development since 1985, is still incomplete, and its total estimated costs may reach $107B by the end of 2007.[2] In other words, the Defense Acquisition System designed to bolster missile defense operational effectiveness within reasonable costs has apparently missed its mark over the past 25 years.

Admittedly, network centric acquisition programs such as missile defense are monumentally complicated on numerous technical levels, expectedly expensive and take decades to develop. Nevertheless, this example may be emblematic of the Defense Acquisition System's questionable results to fully meet warfighter requirements and procurement objectives for its numerous programs. Hence the persistent criticisms. For additional examples, look to other DoD flagship programs such as Joint Strike Fighter (JSF), Air Force F/A-22 Raptor, and Army Future Combat System (FSC). The outcries

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[1] Marshall Engelbeck, "MN3331 Principles of Acquisition Management," (Lecture at the Naval Postgraduate School, Monterey, California, 1st Quarter, 2007).

[2] Department of Defense, "Historical Funding for MDA FY85-07," Missile Defense Agency, http://www.mda.mil/mdalink/pdf/histfunds.pdf (accessed on November 24, 2007).

seem so similar: escalating costs, schedule delays, inefficiency and ineffectiveness, and procurement of systems that may not do what they have been designed to do.[3]

Indeed, the Defense Acquisition System appears to continue to under perform despite revisionist initiatives and multiple studies in search of improvement over the past two decades.[4] Many would probably concede that a sea-change in acquisition affairs may be needed to make it markedly responsive to warfighter requirements. Consequently, well-intentioned reformers steadfastly search for the silver bullet—or at least a few golden nuggets to shift the system toward value-added change.

## B. PURPOSE

The purpose of this study is to analyze the Defense Acquisition System through the theoretical foundation of *systems* thinking, thereby acting to discover areas for improvement relevant to acquisition leaders and managers endeavoring to accomplish mandated acquisition reform, particularly in terms of meeting warfighter procurement requirements for major Defense programs. Short explanations of a warfighter and the Defense Acquisition System follow.

### 1. Warfighter

The term warfighter is a DoD colloquialism, which generally refers to a member of the uniformed Armed Services serving and fighting under America's flag.[5] However, this study interprets a warfighter to be anyone within the DoD—not just the military—that might seek to procure products and services through the Defense Acquisition System. In other words, warfighters are key stakeholders of the system, as they largely identify and filter battle space capabilities and requirements, fund programs, and closely monitor schedules, especially for high cost Major Defense Acquisition Programs (MDAP) or Major Automated Information Systems (MAIS).

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[3] Robert G. Struth Jr., "Systems Engineering and the Joint Strike Fighter: The Flagship Program for Acquisition Reform," *Acquisition Review* Quarterly (Summer 2000): 221.

[4] Gordon England, "Acquisition Action Plan," (Department of Defense memorandum from Acting Deputy Secretary of Defense, June 7, 2005).

[5] Wikipedia the Free Encyclopedia, "Warfighter," http://en.wikipedia.org/wiki/warfighter (accessed on November 24, 2007.

### 2. Defense Acquisition System

The focus of this study is on the Defense Acquisition System. DoD Directive 5000.1 *The Defense Acquisition System* defines the system as "the management process by which the Department of Defense provides effective, affordable, and timely systems to the users."[6] The Defense Acquisition System is an organizationally driven process intended to seamlessly work with the Joint Capabilities, Integration and Development System (JCIDS) and Planning, Programming, Budgeting and Execution (PPB&E) process, whereby all three components serve as Decision Support Systems within the overarching Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management Framework (Figure 1.1).[7]

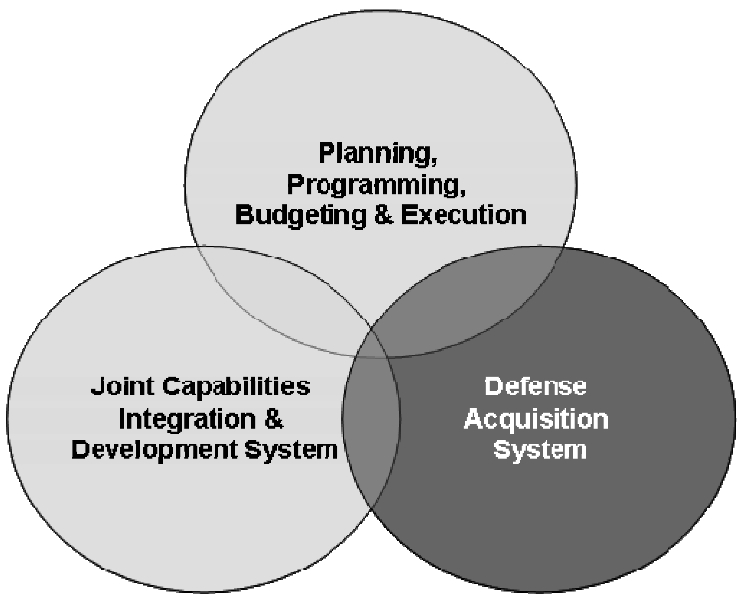


Figure 1.1. Decision Support Systems of the Defense Acquisition Framework (Source: Defense Acquisition Guidebook, 2003)

The Chairman of the Joint Chiefs of Staff (CJCS) lays emphasis on the interrelationships between the Decision Support Systems: "To produce weapon systems

[6] Department of Defense Directive 5000.1, *The Defense Acquisition System*, May 13, 2003.

[7] Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management Framework, ver 5.2, August 2005.

that provide the capabilities our warfighters need, these three processes must be aligned to ensure consistent decisions are made."[8] JCIDS "identifies, assesses, and prioritizes" joint warfighting procurement capabilities and needs per Title 10, United States Code prior to feeding the Defense Acquisition System with requirements.[9] In theory, JCIDS "racks and stacks" acquisition initiatives, as it acts as the gatekeeper to the Defense Acquisition System. The PPB&E process is governed by DoD Financial Management Regulation 7000.14-R and helps allocate resources. It intertwines with the Defense Acquisition System by way of Congressional budgeting cycles and money classifications such as Research and Development (R&D), Procurement, and Operations and Maintenance (O&M).

## C. BENEFITS

This study yields notable *system* improvement opportunities for the Defense Acquisition System, and it provides corresponding recommendations for acquisition leaders, i.e., Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)), particularly with *systemic issues* associated with Management and Fit, Learning, Handling of Input Variability, and Differentiation of Tasks and Workflows. The following offers a snapshot of this study's findings.

### 1. Management and Fit

Current applications of strategies and governing policies, i.e., promulgations of certain *key success factors* and *system direction*, may not fit with the overarching character and identity of the Defense Acquisition System, given that it is endemically tied to the DoD's large, complex, machine-like bureaucracy and susceptible to the whims of its *culture* and *environmental context*.

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[8] Chairman of the Joint Chiefs of Staff Instruction 3170.01F, *Joint Capabilities Integration and Development System*, May 1, 2007.

[9] Chairman of the Joint Chiefs of Staff Instruction 3170.01F, *Joint Capabilities Integration and Development System*, May 1, 2007.

### 2. Learning

The system collectively shows indications of not being able to interpret, filter, and learn from *feedback*, i.e., previous mistakes, mainly due to the system's repeated, *unintended outcomes* of cost overruns, schedule delays, and occasional poor performance of resulting products and services delivered to the warfighter.

### 3. Handling of Input Variability

It looks as if the system experiences tremendous difficulty coping with *input variability*, ironically stemming from potentially ill-fitted strategies designed to adapt to the warfighter’s changing requirements, technological advances, and potent external forces from the system's environment.

### 4. Differentiation of Tasks and Workflows

The system appears to foster disorder with *tasks* and *workflows*, specifically due to inadequate *differentiation* of system functions and corresponding interrelationships, which may be further exacerbated by ad hoc organizational structures, i.e., horizontally matrixed product teams.

## D. ORGANIZATION OF STUDY

This study follows a logical order: Chapter II establishes the foundational tools for analysis; Chapter III conducts the analysis of the Defense Acquisition System; and Chapter IV provides conclusions and recommendations.

Chapter II establishes and describes the theoretical foundations and models for this analysis. Particularly, a short introduction to systems theory establishes the groundwork for the larger discussion of open, organizational systems. Descriptions of the basic elements of open systems follow and serve as a prelude to the more tailored *organizational systems model* coined by Nancy Roberts (1998), which is the primary analytical tool for this study. Chapter II also interweaves organizational configurations, common coordination activities, and basic management approaches, i.e., degree of efficiency and effectiveness, to supplement a greater systems approach.

Chapter III conducts an analysis of the Defense Acquisition System and compares it to the key components of the Roberts *organizational systems model*. Specifically, this chapter focuses on the Defense Acquisition System's *environmental context*, *key success factors*, *system direction*, *design factors*, *culture*, *outputs*, and *outcomes*. Using the model brings the highly complex Defense Acquisition System into focus, as it elucidates important system internal and external relationships.

Chapter IV offers conclusions and recommendations based on the holistic interrelationships between the following: Defense Acquisition System; systems theory; organizational structures, configurations, approaches, and frameworks; and the Roberts *organizational systems model*.

# II. ORGANIZATIONAL SYSTEMS THEORY

This chapter establishes and describes the theoretical foundations, configurations, and models used for analysis in Chapter III. Particularly, a brief introduction to systems theory establishes an underpinning for the larger discussion of open, organizational systems. Explanations of the basic elements of open systems, i.e., *inputs*, *throughput*, *outputs*, *feedback*, and the *environment*, prologue the more tailored Roberts *organizational systems model*, which is the chief analytical tool for this study. The Roberts model evaluates *environmental context*, *key success factors*, *system direction*, *design factors*, *culture*, *outputs*, and *outcomes*. This chapter also addresses relevant organizational configurations, common coordination activities, and basic management approaches, i.e., degree of efficiency and effectiveness, to augment a systems approach.

## A. SYSTEMS THEORY

### 1. Systems

The basic definition of a system is a set of interrelated and interdependent elements, concrete or abstract, that interact together to make up the system's whole for a common purpose.[10] The weather, a car, the human body, a business organization, a web site, a network, and a power plant are all examples of systems. Each system is made up of the necessary components that comprise the system, but "the whole is greater than the sum of its parts."[11] In less conceptual terms, one "can only understand the system of a rainstorm by contemplating the whole, not any individual part of the pattern."[12] Hence, a systems approach is both grounded in everyday forces and examples, and evokes the comprehensive logic of viewing a system in its entirety.

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[10] Francis Heylighen, Cliff Joslyn, and Valentin Turchin, "System," Principia Cybernetica Web, http://pespmc1.vub.ac.be/asc/SYSTEM.html (accessed on November 24, 2007).

[11] Kenneth R. Westphal, *Hegel's Epistemology: A Philosophical Introduction to the Phenomenology of Spirit* (Indianapolis: Hacket Publishing, 2003), 111.

[12] Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York: Currency Doubleday, 1990), 7.

Without all of the integral pieces to a system, however—even losing or changing one key variable—the system may not live up to its full potential. For example, an Air Force fueling operations system is made up of the major components of storage tanks, pipelines, underground hydrants, drivers, fuel trucks, filling stations, accounting personnel, hydrant servicing vehicles, laboratory technicians, and a number of other elements. All of the components exist within this system for the common purpose of providing fuel services to Air Force aircraft on the base's flight line. If one were to remove the filling stations from this particular system, for instance, the fuel trucks would not be able to receive fuel. Consequently, as an example, the fueling operations system would not have the means to provide fuel to aircraft parked at hardstand locations without access to underground hydrants. Note the criticality of all the parts to this simplistic representation of a system. The fuel trucks heavily rely on the filling stations for fuel, which illustrates their importance and interconnectedness within the system.

### 2. General System Theory

Indeed, appreciating the interrelationships among diverse and dynamic (moving) elements is a necessary building block for thinking and acting in systems terms. One only needs to consider Egyptian, Inca, and other societies and philosophers such as Plato and Aristotle to know people of antiquity understood and pondered systems. In *Facets of Systems Science*, George Klir quotes French philosopher, Henri Poincaré, who plainly exclaimed, "The aim of science is not things themselves…but the relations between things; outside those relations there is no reality knowable."[13] The famous German philosopher, Friedrich Hegel, also mused over systems and is credited with highlighting the existence of dynamic relationships between system components.

However, it took until the middle of the 20th century before there was a major breakthrough in the theory of systems. In 1947 Ludwig von Bertalanffy's General System Theory provided a leap forward. The Austrian biologist studied systems with the intent of understanding the underlying principles of the relationships between components and the

[13] George J. Klir, *Facets of Systems Science,* 2nd Edition, (New York: Kluwer Academic/Plenum Publishers: 2001), 3.

external environment of a system, which would eventually reveal the "law of laws" beyond the traditional sciences of chemistry, physics, biology, mechanics and the like.[14] In fact, he believed such dynamics were not only definable but also attributable to all systems, regardless of their purpose. In essence, his vision of a system widened the lens of how a system is viewed.

Nonetheless, Bertalanffy's notion of systems thinking was counter to conventional approaches at the time, which held component-level analysis in high esteem and asserted the totality of the system was simply the linear addition of all the components.[15] Such an analysis of a system was mostly wrong, as Bertalanffy reconfigured previous systems theories. He essentially took systems thinking a step further and chartered an unprecedented, holistic view of systems that went beyond reductionism and mechanism, thus offering a "new paradigm for transdisciplinary synthesis."[16] In the plainest of words, in order to understand a system, one has to interpret the system as a whole body—not just the individual pieces that make up the system. People may have understood the presence and even importance of systems, but Bertalanffy is credited with offering insight into how to study them.

The results of Bertalanffy's General System Theory exponentially expanded systems thought in the middle of the 20th century, as he opened the floodgates for studies of open systems. Prior to his era, most of the conversations about systems revolved around closed systems, which were systems separately considered from their external environment. Theorists primarily concentrated on the concrete relationships within a particular system instead of accounting for exposure to outside influences. General System Theory opened a new window by broadening the purview of systems to include

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[14] Lars Skyttner, *General Systems Theory: Ideas & Applications* (New Jersey: World, 2001), 34.

[15] David S. Walonick, "General Systems Theory," Statpac, http://www.survey-software-solutions.com/walonick/systems-theory.htm (accessed on November 24, 2007).

[16] Ervin Laszlo, "Perspectives on General System Theory: A Collection of Essays," *International Society for the Systems Sciences*, http://www.isss.org/laszlofw.htm (accessed on November 24, 2007).

open systems. As a result, Bertalanffy is frequently credited with jumpstarting the immature discipline of systems engineering, which has only been around for approximately fifty years.[17]

## B. ORGANIZATIONAL SYSTEMS

### 1. Open Systems

Real advancements in systems thinking occurred when theorists piggybacked on Bertalanffy's General System Theory and applied open systems knowledge to organizations. Such theorists more heavily accounted for a system's abstract influences and external effects on an organizational system from its interaction with the environment, inputs, and other systems. A modern day professor straightforwardly describes this fact: "An open system organization is not passive…it reaches out and tries to shape the environment, yet at times, it is at the mercy of the environment."[18] This new aperture to view organizational systems prudently widened the context, and, more importantly, acknowledged relationships with the open environment as being just as critical—if not more critical—as the interrelationships within the system.[19]

The Air Force fuels operations system example mentioned earlier sheds some light on the phenomenon of open systems and an organization. Although it was previously described as a closed system, there was one revelation in the scenario that qualifies it as an open system. For instance, the fact an aircraft is parked at a hardstand without an underground hydrant outlet is not within the control of the fuels operations system. Rather, the location of where to park the aircraft is likely a decision made by ground control personnel—which is an uncontrollable influence external to the system. As a consequence, this unruly circumstance from the environment negatively affects fueling operations by forcing the system to use trucks for refueling the aircraft instead of

[17] Tom Huynh, "SE4011 Systems Engineering for Acquisition Managers," (Lecture at the Naval Postgraduate School, Monterey, California, 3rd Quarter, 2007).

[18] Tom O'Conner, "Foundations of Organizational Theory" North Carolina Westleyan College, http://faculty.ncwc.edu/TOCONNOR/417/417lect01.htm (accessed on November 24, 2007).

[19] Francis Heylighen, "Basic Concepts of the Systems Approach" Principia Cybernetica Web, October 4, 1998, http://pespmc1.vub.ac.be/SYSAPPR.html (accessed on November 24, 2007).

taking advantage of its faster and more efficient hydrant fueling system. Admittedly, the Air Force fueling operations system is able to adapt to its openness, in this case, but the bottom line is the system's openness forced it to interact and adjust accordingly. Hence, the system is not closed and fenced off from outside pressures.

### 2. Basic Components of Open Systems

An open system is most basically represented as an interaction of inputs, throughput, outputs, and feedback that exists within an environment.[20] Figure 2.1 shows the open system's rudimentary components as rectangles and their relationships with directional arrows. This simple illustration of an Input Process Output (IPO) model helps establish a foundational understanding of open systems prior to getting into a more complex representation later in the study, e.g., Roberts' *organizational systems model*. Roberts' version builds upon the representation in Figure 2.1, and introduces more specificity concerning all relevant variables.

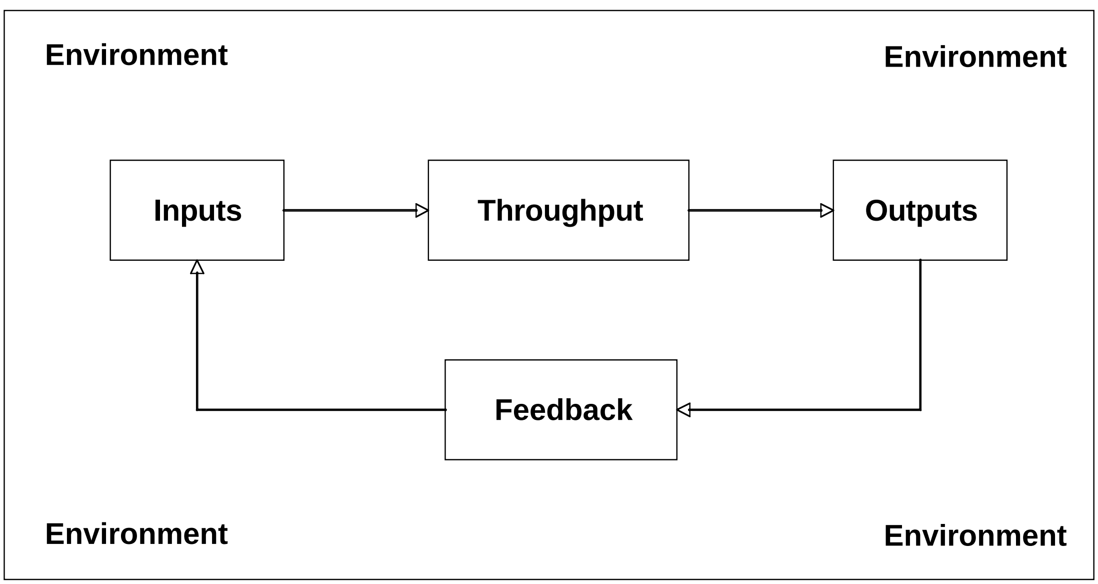


Figure 2.1. Basic Elements of Open Systems (Source: Heylighen, 1998)

[20] Francis Heylighen, "Basic Concepts of the Systems Approach" Principia Cybernetica Web, October 4, 1998, http://pespmc1.vub.ac.be/SYSAPPR.html (accessed on November 24, 2007).

### *a. Inputs*

Some system inputs originate from the external environment, e.g., book order information from Amazon.com customers ordering online, fuel for storage tanks to supply Air Force facilities and operations, school children entering a school, and food and water humans ingest to sustain a hierarchy of systems in the human body. Inputs can be concrete or abstract in nature, and of course, all systems require inputs to survive.[21] Inputs also include how organizational leaders set-direction, i.e., through mission, vision, goals, strategies and policies

### *b. Throughput*

Throughput is essentially the heart of the system's processing. Ideally, this is where value-added activity occurs between the system's internal elements and inputs received, transforming inputs into some other state or result such as goods and services.[22] Continuing the Amazon.com example, the mega online company processes orders through its information processing system to turn requests into sold and delivered books to customers. Amazon.com might use the following resources to accomplish its goals: computers, software, people or employees including their training, experience and knowledge, databases, inventory facilities, books, accounting and payroll processes, and other relevant factors. These resources or variables interact and generate various results. Throughput variables matter and can be referred to as organizational design or architecture.[23] System design is crucial for two important reasons: 1) managers and senior executives on net, have substantial control over their design variables, e.g., changing to a new technology, or controlling how many employees with what skills are hired; and 2) the extent to which the variables fit determines performance, i.e., overarching systems hypothesis.

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[21] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

[22] Derek R Lane, "Chapter 4: Systems Theory," University of Kentucky, www.uky.edu/~drlane/orgcomm /325ch04.ppt (accessed on November 24, 2007).

[23] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

### *c. Outputs*

Outputs are typically tangible goods and services, e.g., how many books sold per time period, freshly lathed and finished baseball bats, numbers of graduate students obtaining Master's degrees, or numbers of aircraft refueled. Outputs are one type of result, another result being outcomes, defined as intended and unintended consequences of the outputs.[24] This result plus organizational culture as an emergent variable are discussed later in the study.

### *d. Feedback*

Feedback is one of the elements of an open system that loops back to let the system know how it is performing. Feedback acts as a regulator or controller of the system, as the system interprets feedback in a positive or negative context. Positive feedback reinforces the system's existing behavior, and negative feedback, alternatively, informs the system that it is functioning poorly and that adjustments are needed, i.e., become dehydrated enough and the feedback loop within the body demands water, or death. Healthy systems are able to accommodate feedback by making internal adjustments to the system.

### *e. Environment*

The external environment includes abstract and concrete factors, forces and trends, particularly those having potential organizational impacts, e.g., rising gas prices for an Air Force, or CNN pictures of a dysfunctional government organization, e.g., the Federal Emergency Management Agency's poor response in Hurricane Katrina. Additionally, theorists claim that organizational systems will entropy—or randomly deteriorate over time—without interaction with the environment.[25] This state of negative

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[24] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

[25] Anthony A. Verstraete, "Systems Approach and IPO Model," Penn State University, http://www.smeal.psu/misweb/systems/sycoipo.html (last accessed on February 28, 2002).

entropy would need to be continually addressed through new inputs such as information, energy, and materials to avoid “increasing levels of disorder” within the system.[26]

### 3. Complexity and Boundaries

All open systems contain various inputs, throughputs, outputs and feedback loops, and all are exposed—more or less—to external environmental forces, i.e., factors impacting an organization over which it may have little to no control. Consider the complexity implied in this modern definition of systems theory and open systems by Heylighen and Joslyn;

> It is the transdisciplinary study of the abstract organization of phenomena, independent of their substance, type, or spatial or temporal scale of existence…investigating both the principles common to all complex entities, and the (usually mathematical) models which can be used to describe them.[27]

What is apparent from this metaphysical explanation is how improbable it is to perfectly characterize open, organizational systems—or even precisely parse out and differentiate between the components described in Figure 2.1. In simpler words, how might one feasibly go about studying an “abstract organization of phenomena” in an organizational system, as described above?[28]

In short, the permutations of open systems are complex, based on hierarchies of interacting systems (a transportation system) and semi-permeable boundaries separating inside the organization from outside the organization. In the previously mentioned fueling operations system, the filling station is its own system even though it is a subsystem within the fueling operations system. Furthermore, the trucks and hydrant servicing vehicles are interacting subsystems within larger and more complex transportation and Defense systems. Hence, systems may not be mutually exclusive from one another, meaning there are innumerable combinations to ponder. This unavoidable reality is why

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[26] Robert C.H. Chia, *In the Realm of Organization: Essays for Robert Cooper* (London: Routledge Books, 1998), 207.

[27] Francis Heylighen and Cliff Joslyn, “What is Systems Theory?” Principia Cybernetica Web, November 1, 1992, http://pespmc1.vub.ac.be/SYSTHEOR.html (accessed on November 24, 2007).

[28] Ibid.

the potential confusion brought on by the openness of organizational systems warrants additional explanation regarding how to cope with the complexity of system boundaries.

Cope is the key word because there is no magic formula for establishing boundaries with open, organizational systems. J.W. Gibbs offers a blunt perspective of this situation with his definition of a system, which affirms the genuineness of how one is forced to deal with system blends and perimeters. He claims, “A system is any portion of the material universe which we choose to separate in thought from the rest of the universe for the purpose of considering and discussing the various changes, which may occur within it under various conditions.”[29] Admittedly, Gibbs confines his definition to the material world, but his point about the selection of system perimeters is still relevant to organizational systems.

The division of organizational systems—whether nature-driven, concrete, or abstract—from one another for the purpose of understanding a single system is not a natural occurrence. Some organizational systems are more difficult to characterize and bind than other organizational systems. The Defense Acquisition System, for example, is substantially more difficult to isolate and analyze than a mom and pop dining system, for instance. Each organizational system is different in size and type, which supports the no set formula claim.

Gibbs’ definition states a fundamental truth: people, for the purpose of analysis, effectively provide the lines of segregation for systems through their own choosing. As a result, there is no alternative but to somehow muddle through system complexities and variables by acknowledging the plethora of possible interactions within and outside the system. One bottom line is for analysts to attempt to logically isolate the system in question prior to accounting for the system’s external influences. Doing this may facilitate a cleaner delineation between a system and its environment, thereby encouraging a more credible analysis of the relationship between the two.

[29] Jack Ring, “Are New Principles Required to Treat Enterprises as Systems?” (Position statement for the International Council on Systems Engineering, June 26, 2007).

### 4. Systems and Configurations

Since organizational systems can be inherently complex and challenging to bind, a framework or model can facilitate a baseline for comprehension.[30] Again, Gibbs' realistic depiction of a system warrants model formulation. If as previously explained organizations can have porous and ill-defined boundaries, then one is faced with important decisions, i.e., how to include WalMart's subcontractors and logistical pipelines with vendors as part of its organizational system, or how to incorporate Amazon.com's online advertising partnerships with Google?

Henry Mintzberg, a renowned business and management researcher, scholar and theorist, offers a framework for understanding and analyzing organizations through his portrayal of five organizational configurations. A configuration includes a cluster of internal and external (situational) variables. Mintzberg's representation starts at the top of a typical organizational hierarchy termed the *strategic apex*, followed by another structural component termed the *middle line,* continuing down into the *operating core.* Two additional side components include a *technostructure* and *support staff*.[31]

Figure 2.2 provides an illustration of Mintzberg's basic components. It is important to note that the proportions of these five structural elements change along with changes in organizational size, type, and situational factors. The *strategic apex* and indeed the other four components are all relatively large in a typical machine bureaucracy, e.g., McDonalds, United States Post Office, and the DoD. In sum, machine bureaucracies tend to require relatively large groupings of all five different kinds of generalized employees designed for predictable, standardized work processes.

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[30] Francis Heylighen, "Basic Concepts of the Systems Approach," Principia Cybernetica Web, October 14, 1998, http://pespmc1.vub.ac.be/SYSAPPR.html (accessed on November 24, 2007).

[31] Henry Mintzberg, *Mintzberg on Management: Inside Our Strange World of Organizations* (New York: The Free Press, 1989), 101.

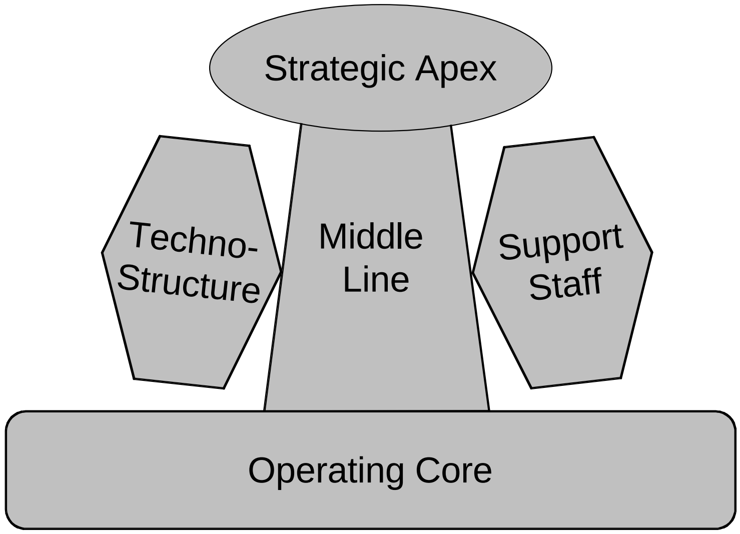


Figure 2.2. Mintzberg’s Machine Bureaucracy (Source: Mintzberg, 1989)

Mintzberg also speaks to five common mechanisms necessary for organizational coordination: 1) *Mutual Adjustment*, 2), *Direct Supervision*, 3) *Standardization of Work Processes*, 4) *Standardization of Work Output*, and 5) *Standardization of Skills and Knowledge*.[32] These common mechanisms of coordination become particularly useful in evaluating the throughput capabilities and control mechanisms within an organization. Mintzberg’s structures and coordinating mechanisms provide a useful platform for analyzing the Defense Acquisition System. His configurations are used as a supplemental model different than but complementary to the *organizational systems model*.

## C. ORGANIZATIONAL SYSTEMS MODEL

The discussion now focuses on the primary organizational systems model developed or finalized by Roberts (1998), which is more detailed than the basic IPO model shown in Figure 2.1. Roberts' model (Figure 2.3) adds some key variables and uses language more helpful for practitioners and leaders contemplating organizational system interventions. Explanations of each of the model's components follow.

[32] Henry Mintzberg, *Mintzberg on Management: Inside Our Strange World of Organizations* (New York: The Free Press, 1989), 104.

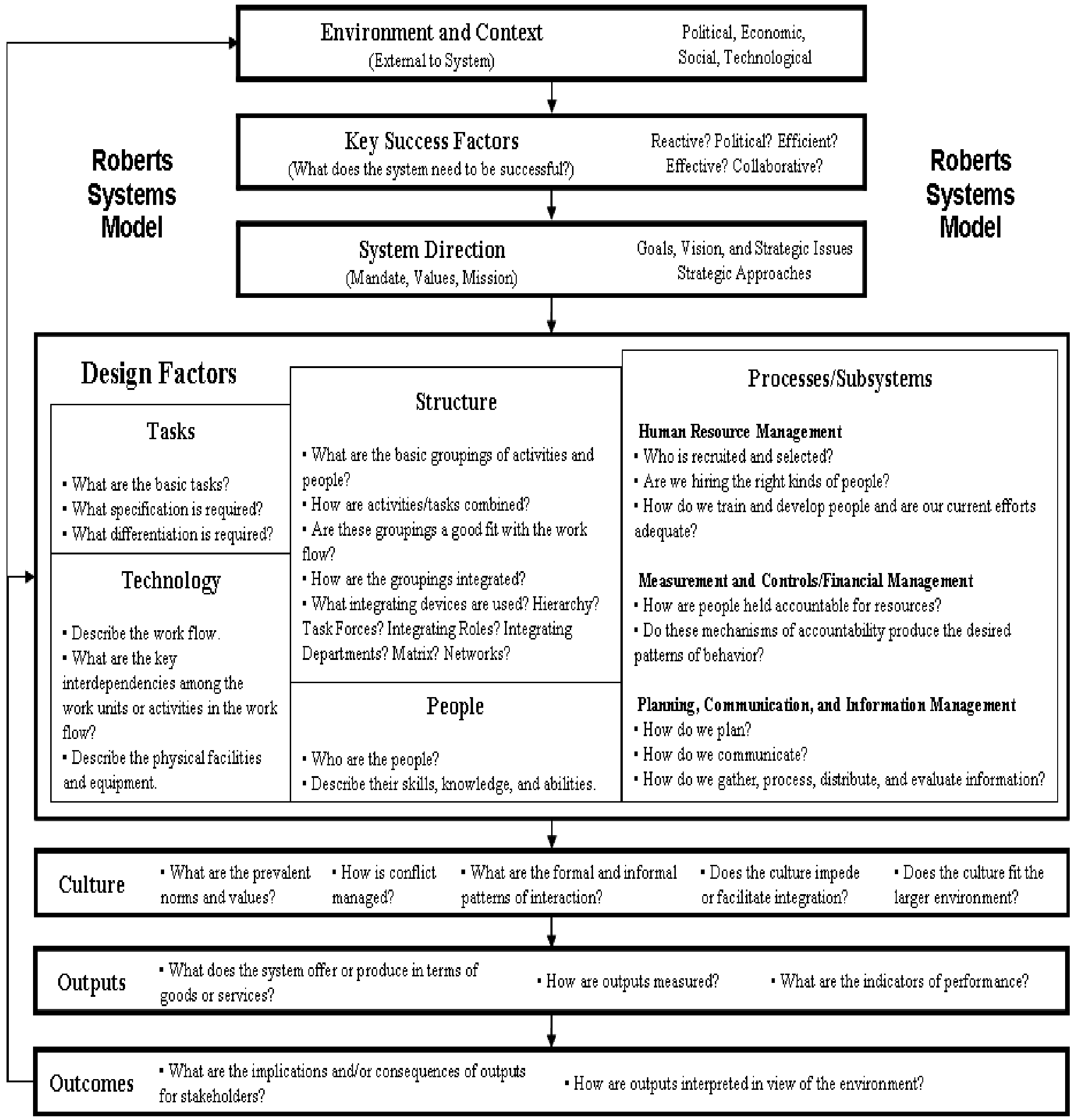


Figure 2.3. Organizational Systems Model (Source: Bruner, 1998)

### 1. Environmental Context

The *organizational systems model* illustrates a generalized direction starting with the *environmental context* that may impact an organization. The external environment

contains threats, opportunities, stakeholders and other raw materials needed to sustain an organization, e.g., political, economic, social, and technological.[33]

### 2. Key Success Factors

*Key success factors* refer to the main things an organization must do to compete and thrive in its respective domain or industry—not always an easy thing to discern. Andrew Carnegie, the famous steel tycoon who migrated from Scotland and settled in the United States, once said, "I believe that the true road to preeminent success in any line is to make yourself master of that line."[34] One could surmise how some organizations spend considerable resources trying to figure out the few key things they must excel in to succeed, especially while environmental forces continually shift and change. Evidence suggests that success factors for public organizations including Defense are greater in number and more ambiguous than private-based organizational factors.[35]

### 3. System Direction

The model's flow continues to a primary input variable, which can be called the first charge of leadership: to set *system direction*. Typically, organizational leaders set *system direction* through goals, mission, vision, policies and strategic plans. Since the systems hypothesis says that the *fit of the variables determines performance*, then the direction of the organization would need to fit external factors, and the design variables would need to fit each other and fit the organization's direction. The notion of fit is that interventions affect other variables, thereby placing the system in greater or lesser overall

[33] Anthony A. Verstraete, "Systems Approach and IPO Model," Penn State University, http://www.smeal.psu/misweb/systems/sycoipo.html (last accessed on February 28, 2002).

[34] Andrew Carnegie, "Success," http://www.dailyinspiringquotes.com/successtwo.shtml (accessed November 24, 2007).

[35] Bradley D. Bruner, "An Organizational Analysis of the Military (Navy) Personnel Plans and Policy Division," (Masters thesis, Naval Postgraduate School, September 1998), 10.

congruence. The overall challenge, therefore, is recognizing and differentiating external factors and forces, and setting a *system direction* that fits or is aligned with these powerful forces.[36]

### 4. Design Factors

*Design factors* come next, which are sometimes alluded to as the "black box of management."[37] Although the organizational system attempts to embody its *key success factors* and set *system direction*, it is the manipulation of the system's *design factors* that most directly shape the system's results: *culture, outputs,* and *outcomes*. Hence, the *design factors* component happens to be one of the most critical aspects of any organizational system. Also called an organization's architecture, *design factor* variables include *technology, people, tasks, structure* and *processes*.

#### *a. Tasks*

*Tasks* address the basic activities occurring within an organizational system. Filling a storage tank is an example of a *task* required of a fuels operations system. This factor includes delineating specifications of each *task* as well as differentiating between the *tasks*. For instance, the amount of fuel required to fill up the storage tank addresses the specification, and the fact this activity is separate from filling up a truck's fuel tank addresses differentiation.

#### *b. Technology*

*Technology* refers to how an organization accomplishes its primary workflow, integral for converting inputs to desired results.[38] *Technology* can be described

[36] Raymond E. Miles, Charles C. Snow, Alan D. Meyer, and Henry J. Coleman, Jr., "Organizational Strategy, Structure, and Process," *The Academy of Management Review* Vol. 3 No. 3 (July 1978): 546-562.

[37] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

[38] Daniel Robey, *Designing Organizations: A Macro Perspective* (Homewood, Illinois: Richard D. Irwin, 1982), 98.

in terms of the degree of interdependence or interrelationships needed to accomplish the work, i.e., greater interdependencies require different kinds of *technologies* or workflows between *tasks*.

#### ***c. Structure***

*Structure* is a basic building block of all organizations, ranging from simple family-owned business structures, to fundamental differences between machine and organic structures, e.g., machine and professional bureaucracies in the former and matrix and "boundaryless" structures in the later.[39] The central hypothesis is the same. The extent to which an organization's structure fits other design variables, including its direction and success factors, determines performance. Discontinuity among and between variables can generate cultural conflicts and systemic problems, which translates into poor or degraded organizational performance, especially in large, complex public agencies and bureaus.[40]

#### ***d. People***

Understanding the background, capabilities, and experience of *people* working within the organizational system is a significant *design factor*. Specifically, organizational leaders should account for the *knowledge*, *skill*, and *ability* of personnel within the organization.

#### ***e. Processes/Subsystems***

*Processes/Subsystems* is a *design factor* that contains three main categories, but includes an organization's reward process as well: 1) *Human Resource Management*, 2) *Measurement and Controls* to include *Financial Management*, and 3) *Planning, Communication, and Information Management*.

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[39] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

[40] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

*Human Resource Management* typically includes recruiting, hiring, promotion and other policies, generally reflecting the management of people. Important questions include: How does the organization recruit and select the right people for current and future needs? How does the organization determine who to promote and who to let go? How does the organization provide adequate training and motivation? Answers to these types of questions are relevant when considering *Human Resource Management*. Recognition, punishment and reward factors are also applicable.[41]

*Measurements and Controls*, which includes *Financial Management* and oversight of the organizational system's budget, relates to how people are held accountable for their actions and resources, i.e., rules and regulations or laws. Examples in this area also include pay and benefits and the quality of computers provided to personnel. The idea is to ensure that measurement and control policies and actions serve to generate the desired effects, both financially and culturally.

*Planning, Communication, and Information Management* includes how the organization plans, communicates, and converts data and information into usable knowledge. Communication technologies can contribute or degrade actual communication, i.e., using a hand-held device to communicate with other employees while simultaneously participating in a group meeting. This may help or hinder information management methodologies, which includes gathering, processing, distributing and evaluating information.

### 5. Results (Culture, Outputs, and Outcomes)

Interestingly and crucial to the model are three forms of organizational results, or emergent variables: *culture, outputs* and *outcomes*. Organizational *culture* refers to behaviors, language, repeated patterns, and an accepted view of how things generally get done. *Cultural* value differences can require conflict management and resolution practices. *Outputs* typically refer to the goods and services produced by the organizational system. Additionally, o*utputs* are closely connected to what is typically

[41] Bradley D. Bruner, "An Organizational Analysis of the Military (Navy) Personnel Plans and Policy Division," (Masters thesis, Naval Postgraduate School, September 1998), 12.

referred to as an organization's ability to perform, i.e., generate desired goods or services, which then generate intended or unintended consequences, called *outcomes*.[42] An example of an unintended *outcome* is an auto manufacturer that produces a car that is rejected by the general public, as revealed by poor sales revenue. On the other hand, an intended *outcome* would be a highly desired or improved mode of transportation.

## D. EFFICIENCY AND EFFECTIVENESS

The discussion of organizational systems thus far has centered on system attributes and mechanics with only implicit references to efficiency and effectiveness—which are often times considered *key success factors* of systems. How efficiency and effectiveness are defined matters because they are different, even opposing concepts. Efficiency means the minimal amount of energy and resources used to accomplish a task.[43] Effectiveness refers to bringing about a desired end state, including adapting to a changing external environment.[44]

Ostroff and Schmidt define efficiency and effectiveness and provide a useful description of the relationship between the two factors:

> Efficiency and effectiveness are performance domains that have been clearly distinguished. Efficiency refers to an input-output ratio or comparison, whereas effectiveness refers to an absolute level of either input acquisition or output attainment (Pennings & Goodman, 1977). Although the best performing organizations are both effective and efficient (Katz & Kahn, 1978), there may be tradeoffs between the two (Mahoney, 1988). Progression along one performance dimension could entail regression along another (Kopelman, Brief, & Guzzo, 1990). Thus, an organization can be effective, efficient, both, or neither.[45]

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[42] Nancy Roberts, "The System Model," Naval Postgraduate School, unpublished, 1998.

[43] Wiktionary Open Content Dictionary, "Efficiency," http://en.wiktionary.org/wiki/efficiency (accessed on October 23, 2007).

[44] Bradley D. Bruner, "An Organizational Analysis of the Military (Navy) Personnel Plans and Policy Division," (Masters thesis, Naval Postgraduate School, September 1998), 15.

[45] Cheri Ostroff and Neal Schmitt, "Configurations of Organizational Effectiveness and Efficiency," *The Academy of Management Journal* Vol. 36 No. 6 (Dec 1993): 1345-1361.

One essential distinction is solving the paradox inherent between the two terms, i.e., is it best to be streamlined and lean with no waste (highly efficient), or is it more prudent to experiment with different approaches in a changing environment, entailing surplus resources and encouraging failure as a requisite for successful adaptation?

Roberts also offers a *public management approach model*, which illustrates the relationship between efficiency and effectiveness, specifically for public sector organizations, shown in Figure 2.4. The *directive* quadrant reflects a well-oiled machine with top-down strategic planning and control, referred to earlier as a typical machine bureaucracy, i.e., aircraft carrier or DoD. The *generative* quadrant reveals a steward type of organizational system with high efficiency and high effectiveness, generated through collaborative and cooperative stakeholders. The *adaptive* quadrant highlights an organization as a champion of innovation demonstrating high effectiveness but low efficiency, i.e., early NASA. In the *responsive* configuration an organization is not concerned with efficiency or effectiveness, but with brokering power and responding to crises, i.e., Federal Emergency Management Agency (FEMA).

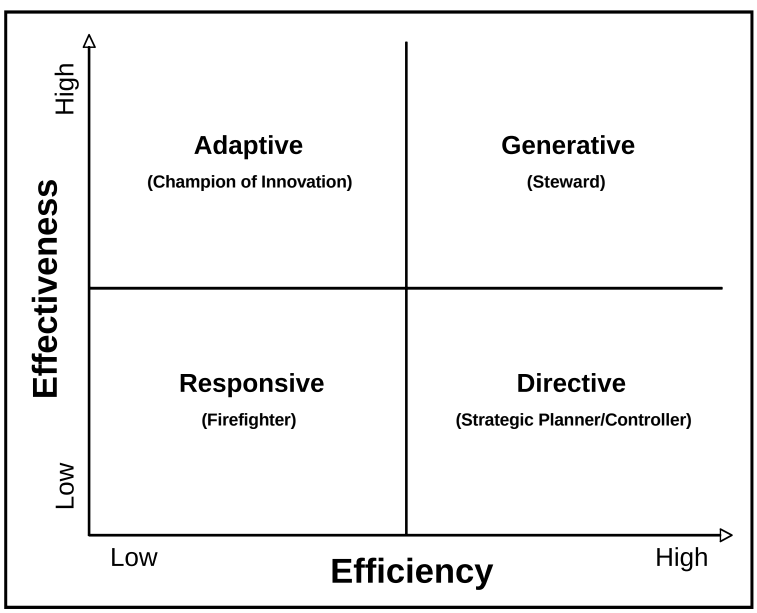


Figure 2.4. Public Sector General Management Approaches (Source: Roberts, 2001)

# III. ANALYSIS OF THE DEFENSE ACQUISITION SYSTEM

This chapter conducts an analysis of the Defense Acquisition System and contrasts it to the key variables of the Roberts *organizational systems model* discussed in Chapter II. Specifically, this chapter focuses on the Defense Acquisition System's *environmental context*, *key success factors*, *system direction*, *design factors*, *culture*, *outputs*, and *outcomes*. While using the components of the Roberts *organizational systems model* does not illuminate every detail of the Defense Acquisition System, it does generally reveal the character of the system for the purpose of a system analysis.

## A. ENVIRONMENTAL CONTEXT

The Defense Acquisition System is subject to external influences from its environment. These forces originate as mutual exclusions external to the system but ultimately interact and affect the system's performance, as the system adapts and adjusts accordingly. The significant environmental stimuli that constantly permeate the Defense Acquisition System are *political forces*, *budget constraints*, *commercial and economic influences*, *changing threats*, *technological advances*, and *media (societal) pressures*.

### 1. Political Forces

*Political forces* routinely interact with the Defense Acquisition System, mainly through formal and informal Congressional oversight, changes in Presidential administration, and Congressional schedules. Formal Congressional oversight refers to the traditional oversight witnessed with committees such as the House Armed Services Committee, Senate Armed Services Committee (SASC), and various other committees and subcommittees in Congress. The SASC, for example, is charged with oversight of the Department's aeronautical and space activities relating to acquisition of weapon systems, military operations, and military research and development.[46]

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[46] United States Senate, "Committee Jurisdiction," U.S. Senate Committee on Armed Services, http://armed-services.senate.gov/about.htm (accessed on November 10, 2007).

Formal Congressional committees, which are indeed political institutions, provide hearings for key Defense Acquisition System leaders to defend program budgets and provide status updates, particularly with high dollar MDAP and MAIS programs. Hence, some argue the acquisition system's programs succumb to the whims of legislators whose focus is on reelection; thus, oversight activities resemble intentions of political profit instead of the best interests of National Defense.[47] Regardless of the motives of Congress, pure or otherwise, formal oversight is a component of the environment the Defense Acquisition System continually interacts with. As a recent example, the House Armed Services Air and Land Forces Subcommittee cut $867 million from the Army's premier FCS program budget.[48] This decrease in funding happened despite the Defense Acquisition System's built-in mechanisms for prioritization, milestone decisions, and program approval.

Another form of a political *environmental context* that has an impact on the Defense Acquisition System is informal Congressional oversight, which occurs through networking and circumvention of committees through well-established ties between politicians and members of the DoD.[49] For example, the Army FCS, a high profile, complex, and risky Defense program, is slated to cost nearly $160 billion through 2022 for research, development, and procurement.[50] This multibillion-dollar program's tentacles stretch across 240 Congressional districts in the continental United States, which share geographical (and political) purview over the Army and commercial marketplace, including Boeing Corporation, the FCS Lead System Integrator.[51] Consequently, this particular acquisition program engenders lawmaker interest, making

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[47] James M. Lindsay, "Congressional Oversight of the Department of Defense: Reconsidering the Conventional Wisdom," *Armed Forces and Society* Vol. 17 No. 1 (Fall 1990): 7-33.

[48] Megan Scully, "House Panel Cuts $867 Million from Future Combat Program," Government Executive.com, May 2, 2007, http://www.govexec.com/story_page.cfm?articleid=36791&sid=21 (accessed on November 24, 2007).

[49] James M. Lindsay, "Congressional Oversight of the Department of Defense: Reconsidering the Conventional Wisdom," *Armed Forces and Society* Vol. 17 No. 1 (Fall 1990): 7-33.

[50] Andrew Feickert, "The Army's Future Combat Systems (FCS): Background and Issues for Congress," Congressional Research Service Report for Congress, April 28, 2005.

[51] United States Army, "Future Combat Systems," http://www.army.mil/fcs (accessed on November 24, 2007).

FCS a hot bargaining chip, vulnerable to Congressional capriciousness from its informal alliances.[52] The Army FCS serves as only one of many programs within the Defense Acquisition System that is susceptible to informal Congressional oversight. Another noteworthy example of informal Congressional oversight and influence occurred in 2003 when Arizona Senator, John McCain, spearheaded the cancellation of the Air Force's controversial airborne refueling tanker lease and acquisition of Boeing 767s to replace aging KC-135 Stratotankers.

A change in Presidential administration is yet another political influence on the Defense Acquisition System. Such a transformation often results in a whole new regime of civilian leadership with referential power over military and civilian personnel working within the acquisition system.[53] For example, President George W. Bush appointed Paul Wolfowitz as Deputy Secretary of Defense (DEPSEC) in 2001. Not long after taking office, Wolfowitz emphatically declared the Defense Acquisition System broken and cancelled preexisting DoD 5000 series directives, instructions, and regulations related to acquisition policy and guidance.

Essentially, on October 30, 2002, the new DEPSEC created significant turmoil within the acquisition system by requiring the USD (AT&L), Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD (C3I)), and the Director, Operational Test and Evaluation (DOT&E) to rewrite the entire set of acquisition guidance documents, the DoD 5000 series, within 120 days.[54] The Wolfowitz initiative expected acquisition leaders to "create an acquisition policy environment that fosters efficiency, flexibility, creativity, and innovation."[55] Such a circumstance illustrates how the Defense Acquisition System is at the mercy of not just its own military leaders but civilian appointees as well.

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[52] Joseph Yakovac, "MN4307 Program Management Policy and Control," (Lecture at the Naval Postgraduate School, 1st Quarter, 2008).

[53] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

[54] Paul Wolfowitz, "Defense Acquisition," (Department of Defense memorandum for Secretaries of the Military Departments, October 30, 2002).

[55] Ibid.

Congressional schedules and budget cycles also serve as a potent *environmental context* for the Defense Acquisition System. The system balances Congressional schedules and budget cycles in order to periodically plan, budget, gain approval, and provide status of major acquisition programs. However, it is especially challenging when scheduling and working around proceedings during the first and fourth quarters of the DoD's fiscal year.[56] The first quarter occurs over the holiday season from October to December. The fourth quarter, which falls between July and September, presents scheduling challenges as well, especially since Congress is on summer break for approximately a month of that time. This year, the 110th Congress was on recess from August 6, 2007 to September 3, 2007. Consequently, the Defense Acquisition System works within its political environment, as it balances a myriad of acquisition programs with the competing agendas, schedules, and budget cycles of Congress. When major programs attempt to align with Congressional schedules and budgeting cycles, the system sometimes has to wait.[57]

### 2. Budget Constraints

Congress controls the checkbook, as the colloquialism goes. Hence, the reality of *budget constraints*, which is a significant force behind *political influence*, is an *environmental context* with which the Defense Acquisition System must interact. Particularly, *budget constraints* influence the system because of finite resources and budgetary law. The Defense Acquisition System and its comprising organizations manage finite resources among competing acquisition and political interests, and therefore must stretch funds across all of its DoD programs. For example, the Department of the Navy funds the Marines' acquisition of the V-22 Osprey while modernizing Navy sea power capabilities. The Air Force spreads funding across the F/A-22 Raptor, JSF, and

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[56] Joseph Yakovac, "MN4307 Program Management Policy and Control," (Lecture at the Naval Postgraduate School, 1st Quarter, 2008).

[57] Joseph Yakovac, "MN4307 Program Management Policy and Control," (Lecture at the Naval Postgraduate School, 1st Quarter, 2008).

Air Operations Center (AOC) upgrades. Further examples of the limitations of finite resources abound within the Defense Acquisition System because it is a recurring and significant influence on the system.

The constraint of budgetary law is an additional *environmental context*. Specifically, for the Defense Acquisition System, this budgetary control involves the type of Congressional Appropriation or "color of money" further limiting flexibility, in accordance with Public Law 101-510, for the various program phases within the system. The system's R&D, Procurement, and O&M funds all have life spans of two years, three years, and one year respectively. Hence, the system cannot use O&M funds for R&D activities and vice versa. The system fundamentally manages and works within these budgetary laws, rules, and guidelines where each budget category is intermixed throughout system phases. Additionally, the system is required to work within the confines of budgetary appropriation, apportionment, commitment, obligation, expenditure, and expiration laws and guidance.[58] Figure 3.1 below reveals how R&D, Procurement, and O&M funds are accessible for obligation and expenditure before the funding is canceled and cannot be used for any purpose.[59]

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[58] John Mutty, "GB4053 Defense Budget and Financial Management Policy," (Lecture at the Naval Postgraduate School, 2nd Quarter, 2007).

[59] Holley Freidrich, "Color of Money," Defense Contract Management Agency, February 27, 2003, https://acc.dau.mil/CommunityBrowser.aspx?id=18731&lang=en-US (accessed on November 24, 2007).

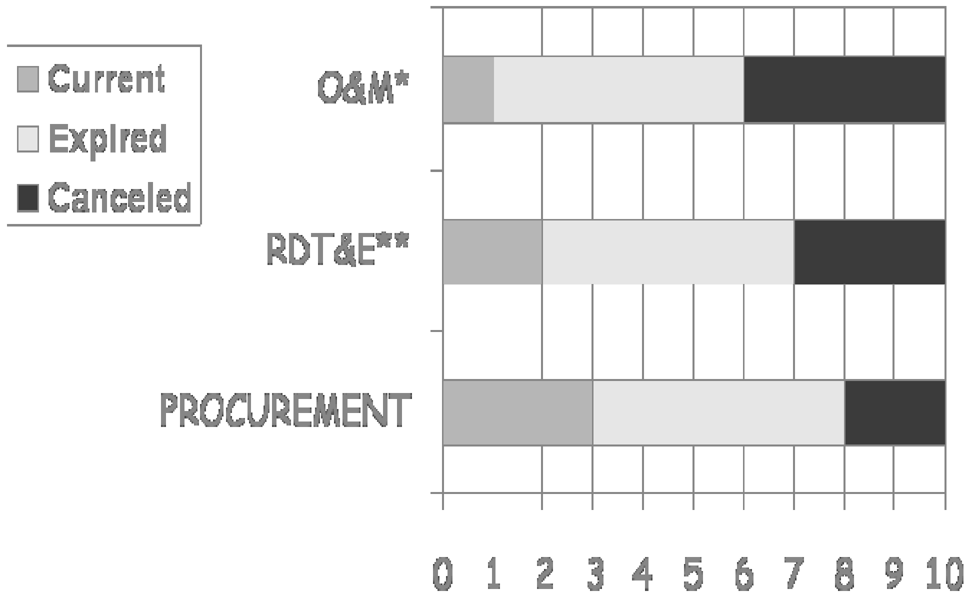


Figure 3.1. Acquisition Funding Categories (Source: Freidrich, 2003)

### 3. Commercial and Economic Influences

*Commercial and economic influences* are also factors of the Defense Acquisition System's environment, specifically with commercial industry motivated by profit and economic downturns and upturns. The system operates within a free society and therefore is open to the market forces of American enterprise. By law, although there may be exceptions in the Federal Acquisition Regulation (FAR), the system must negotiate fair and reasonable contracts for its procurements via competitive solicitations. Consequently, the Defense Acquisition System becomes part and parcel of the commercial marketplace, literally "dealing" and "negotiating" with the likes of Boeing, Lockheed Martin, Northrop Grumman, General Dynamics, and a multitude of other Defense contractors.

*Economic influences* also affect the system. Fluctuations with interest rates, domestic and overseas stock markets, unemployment, precious metals and materials, chemicals, labor and overhead rates, oil prices, and foreign exchange rates are some of the countless economic variables that impact the Defense Acquisition System. To take a minor example, the JSF program breached a Nunn-McCurdy (public law) cost growth limitation in 2005, where the price per aircraft exceeded 30 percent of its baseline cost

estimate in 2001.[60] A very small percentage of the cost growth of nearly $68 billion was due to labor rate and overhead changes brought on by inflation over the same period.[61] Although inflation of labor rates and overhead were small impressions proportional to the operational reasons for JSF cost growth, this instance illustrates the Defense Acquisition System's susceptibility to economic influences—even at seemingly insignificant levels.

### 4. Changing Threats

The Defense Acquisition System operates within an evolving and *changing threat* environment. A persistently changing enemy threat landscape affects National Defense strategy and combatant commander tactics, which shape requirements for capabilities needed within the battle space. As an example, after the terrorist attacks on September 11, 2001 and subsequent onset of the Global War on Terror (GWOT), it appears the nature of American warfighting dramatically shifted from a single-minded, force-on-force (Cold War) approach to a philosophy with more emphasis on lighter, more deployable, and more nimble warfighting wherewithal. The National Defense Security Strategy clearly states, "The struggle against global terrorism is different from any other war in our history…fought on many fronts against a particularly elusive enemy over a long period of time."[62] Consequently, the resulting tactics to locate and kill GWOT adversaries demand the Defense Acquisition System provide cutting edge technologies to meet the changing and adaptive threat posed by terrorism.

The aforementioned example illustrates how the Defense Acquisition System is a perpetual recipient of changing requirements resulting from *changing threats*, which flow into the system through the JCIDS process. There are numerous procurements in the acquisition system's pipeline that are presently designed to mirror the new threat environment. Acquisition initiatives such as enhancement of unmanned aerial vehicles,

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[60] Christopher Bolkcom, "F-35 Joint Strike Fighter (JSF) Program: Background, Status, and Issues," Congressional Research Service Report for Congress, July 19, 2007.

[61] Ibid.

[62] President of the United States, "The National Security Strategy of the United States of America," The White House, http://www.whitehouse.gov/nsc/nss.html (accessed on November 10, 2007).

integration of net centric command and control, and refined intelligence gathering capabilities exemplify how the current threat environment shapes the acquisition system.

### 5. Technological Advances

*Advancements in technology* are a part of the Defense Acquisition System's *environmental context* as well. A common measure for this fairly recent phenomenon is demonstrated with Moore's Law, which is a theory used to explain the exponential leaps in technology, particularly evident since the late 1980s. Moore's Law states the number of transistors that are possible to install on an integrated circuit doubles every eighteen months to two years.[63] When Moore, a co-founder of Intel Corporation, stumbled upon this law in 1966, a chip could accommodate 22,000 transistors, which is dramatically fewer than the hundreds of millions envisioned for the future.[64] The pace and magnitude of technological advancements combined with the relatively long acquisition cycle is a significant challenge for the system, and ultimately the DoD.

*Technological advancement* forces the Defense Acquisition System to confront an appreciable doubling of computing power and capacity with regard to memory and storage. Current commercial computers, for example, commonly have gigabytes of storage capacity where twenty or forty megabytes used to be considered top-of-the-line fifteen years ago. This observable fact does not create complexity issues so much with hardware development but with software development of complex military systems, as acquisition programs are compelled to take advantage of computing capacity with more multifaceted and integrated software products.

An example of how *technological advancement* plays into the acquisition system's *environmental context* is with the Air Force's F/A-22 Raptor procurement. The Raptor program experienced many delays between the mid 1980s and early 2000s, mostly due to its unprecedented complexity, but partly as a result of technological leaps occurring during the life of the program's design and development. The Raptor's

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[63] Gordon E. Moore, "Moore's Law," Intel, http://www.intel.com/technology/mooreslaw/index.htm (accessed on November 24, 2007).

[64] Gordon E. Moore, "Moore's Law," Intel, http://www.intel.com/technology/mooreslaw/index.htm (accessed on November 24, 2007).

progression coincidentally ran parallel with Moore's era of technological explosion, which required the acquisition system to routinely upgrade the F/A-22 Raptor's integrated avionics suite as new technologies emerged.[65]

#### 6. Media (Societal) Pressures

The Defense Acquisition System, primarily resulting from high cost or controversial weapons programs, receives significant and critical attention from the *media*, which is a form of *societal pressure* on the system. This *environmental context*, as an example, is evidenced by the Navy's well-publicized cost overruns and schedule delays with its initial procurement of the Littoral Combat Ship (LCS) fleet, which is designated for modern coastal warfare. The Navy's original baseline for the LCS program called for Lockheed Martin and General Dynamics to each build two ships: ships number one and three built by Lockheed Martin, and ships number two and four built by General Dynamics. At the onset of the program, the Navy was elated to be in the midst of acquiring "a small, fast, affordable ship" that is supposed to "transform naval operations in the littorals," and the Defense contractors had high hopes of delivering on their promises.[66]

In November of 2007, however, the Department of the Navy broke off contract negotiations with General Dynamics and swiftly cancelled planned construction of LCS-4. This decision piggybacked on an earlier pronouncement in April of 2007 to break off negotiations with Lockheed Martin and cancel LCS-3. One of the drivers of these cancellations, aside from endemic risk and budgetary constraints, was the well-advertised cost growth on LCS-1 and LCS-2. Headlines in the *Washington Post* such as "Costs Ballooning for New Combat Ship" found their way in mainstream newspapers, websites, television, radio, and other forms of media.[67] Consequently, the *media's scrutiny*

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[65] Obaid Younossi, David E. Stem, Mark A. Lorrell, and Francis M. Lussier, *Lessons Learned from the F/A-22 and F/18-E/F Development Programs* (Santa Monica: Rand Corporation, 2005).

[66] United States Navy, "What is LCS?" Program Executive Office for Littoral Combat Ship, September 14, 2007, http://peoships.crane.navy.mil/lcs/program.htm (accessed on November 24, 2007).

[67] Renae Merle, "Costs Ballooning for New Combat Ship," WashingtonPost.com, March 1, 2007, http://www.washingtonpost.com/wp-dyn/content/article/2007/02/28/AR2007022802143.html (accessed on November 10, 2007).

revealed lackluster cost control on the part of the contractors and poor program management on the Navy's side. Some claim the media pressure inflicted on the system undoubtedly had an impact on the Navy's decision to cancel LCS-3 and LCS-4, especially when coupled with the *political influence* discussed earlier.

## B. KEY SUCCESS FACTORS

*Key success factors* are the general things the organizational system needs to do in order to be successful. Roberts suggests many *key success factors* are likely for large, public organizations like the Defense Acquisition System.[68] In this system's case, there is no specific manual or document that explicitly calls out *key success factors*. However, there are 34 policies identified in DoD Directive 5000.1 *The Defense Acquisition System*, which, given Roberts' explanation, may qualify as *key success factors*. According to the 5000 directive, five govern the system, and 29 apply to the system—and all are designed to be gateways to system success.

DoD Directive 5000.1 specifically states the following policies govern the Defense Acquisition System: Flexibility, Responsiveness, Innovation, Discipline, and Streamlined and Effective Management.[69] Because these five governing policies (*key success factors*) are critical to this analysis, their descriptions, which are extracted from DoD Directive 5000.1, Section 4.3, are provided below:[70]

### 1. Flexibility

*There is no one best way to structure an acquisition program to accomplish the objective of the Defense Acquisition System. Milestone Decision Authorities (MDA) and Program Managers (PM) shall tailor program strategies and oversight, including documentation of program information, acquisition phases, timing and scope of decision reviews, and decision levels, to fit the particular conditions of that program, consistent with applicable laws and regulations and the time-sensitivity of the capability need.*

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[68] Bradley D. Bruner, "An Organizational Analysis of the Military (Navy) Personnel Plans and Policy Division," (Masters thesis, Naval Postgraduate School, September 1998), 10.

[69] Department of Defense Directive 5000.1, *The Defense Acquisition System*, May 13, 2003.

[70] Ibid.

### 2. Responsiveness

*Advanced technology shall be integrated into producible systems and deployed in the shortest time practicable. Approved, time-phased capability needs matched with available technology and resources enable evolutionary acquisition strategies. Evolutionary acquisition strategies are the preferred approach to satisfying operational needs. Spiral development is the preferred process for executing such strategies.*

### 3. Innovation

*Throughout the DoD, acquisition professionals shall continuously develop and implement initiatives to streamline and improve the Defense Acquisition System. MDAs and PMs shall examine and, as appropriate, adopt innovative practices (including best commercial practices and electronic business solutions) that reduce cycle time and cost, and encourage teamwork.*

### 4. Discipline

*PMs shall manage programs consistent with statute and the regulatory requirements specified in DoD Directive 5000.1 The Defense Acquisition System and DoD Instruction 5000.2 Operation of the Defense Acquisition System. Every PM shall establish program goals for the minimum number of cost, schedule, and performance parameters that describe the program over its life cycle. Approved program baseline parameters shall serve as control objectives. PMs shall identify deviations from approved acquisition program baseline parameters and exit criteria.*

### 5. Streamlined and Effective Management

*Responsibility for the acquisition of systems shall be decentralized to the maximum extent practicable. The MDA shall provide a single individual with sufficient authority to accomplish MDA-approved program objectives for development, production, and sustainment. The MDA shall ensure accountability and maximize credibility in cost, schedule, and performance reporting.*

### 6. Additional Key Success Factors

DoD Directive 5000.1 highlights 29 additional policies that might also be categorized as *key success factors* to the Defense Acquisition System. Simply noted here, Enclosure 1.0 of the 5000 directive identifies the following policies:

- Armaments Cooperation
- Collaboration
- Competition
- Cost and Affordability
- Cost Realism
- Cost Sharing
- Financial Management
- Independent Operational Test Agency
- Information Assurance
- Information Superiority
- Integrated Test and Evaluation
- Intelligence Support
- Interoperability
- Knowledge-based Acquisition
- Legal Compliance
- Performance-Based Acquisition
- Performance-based Logistics
- Products Services and Technologies
- Professional Workforce
- Program Information
- Program Stability
- Research and Technology Protection
- Safety
- Small Business Participation
- Software Intensive Systems
- Streamlined Organizations
- Systems Engineering
- Technology Development and Transition
- Total Systems Approach

## C. SYSTEM DIRECTION

The *system direction* component of the Roberts *organizational systems model* acts as the input compass for the overall system and highlights the mandate, mission, values, and vision of the system. It also emphasizes the strategies that allow the system to

accomplish its goals. The Defense Acquisition System’s *system direction* is largely communicated through 5000 series directives and instructions with a release date of May 12, 2003. This study acknowledges there have been numerous tweaks and changes in *system direction* since the inception of DoD Directive 5000.1 in July 1971.[71] Below is the current account of *system direction*.

### 1. Mandate, Mission, and Vision

The following subsection from DoD Directive 5000.1 expresses the Defense Acquisition System’s mandate, mission, and vision:

> The Defense Acquisition System exists to manage the nation's investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support the United States Armed Forces. The primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price. The investment strategy of the Department of Defense shall be postured to support not only today's force, but also the next force, and future forces beyond that.72

In short, the Defense Acquisition System’s reason to exist is to manage the Nation’s investments and develop its resources in support of the National Security Strategy. The system also exercises the mission of acquiring timely, cost-efficient, quality products in support of the Department’s warfighters. Lastly, this study recognizes there is no overt delineation of core values in the present 5000 series policy and documentation (possibly mixed in with *key success factors* mentioned previously), meaning it must draw from the espoused values of DoD organizations like the Air Force, e.g., Integrity First, Service Before Self, and Excellence in all We Do.

### 2. Goals

Neither of the 5000 series documents explicitly recognizes goals for the overall system. Rather, the goals of the Defense Acquisition System stem from the individual

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[71] Joe Ferrara, “DoD’s 5000 Documents: Evolution and Change in Defense Acquisition Policy,” *Acquisition Review Quarterly* (Fall 1996): 111.

[72] Department of Defense Directive 5000.1, *The Defense Acquisition System*, May 13, 2003.

acquisition programs that flow through the system. The *Defense Acquisition Guidebook*, which is a guide designed to complement 5000 series acquisition documents, categorizes the primary goals for all acquisition programs that pass through the system. Section 2.1 of the *Defense Acquisition Guidebook* states: “Program goals are the minimum number of cost, schedule, and performance parameters necessary to describe program objectives.”[73]

Essentially, the goals of the Defense Acquisition System take the form of ***cost***, ***schedule***, and ***performance*** objectives for each program. The Acquisition Program Baseline (APB) documents program goals, which are derived from warfighter schedule and performance requirements as well as estimated cost projections for the life cycle of the program.[74] Fundamentally, schedule and performance requirements (which, in the Defense Acquisition System's case, are synonymous with goals) originate outside of the system from the Joint Capabilities and Integration and Development System (JCIDS). These requirements enter the system in the form of inputs. Cost projection goals are typically products of inner system development and processing and are designed to focus on Total Ownership Cost (TOC), but are often sub optimized on procurement costs.

It is also important to note that the goals established for a given acquisition program are not static. Goals change as a program flows through the system, which could be positive or negative. This occurs despite the establishment of an APB and is sometimes referred to as *requirements creep*.[75] In a general sense, *requirements creep* traditionally happens when an acquisition program evolves through the acquisition system and discovers it needs to change or depart from the original cost, schedule, or performance requirements. *Requirements creep* may be beneficial, for example, through the incorporation of updated technology,[76] or detrimental as unforeseen system requirements are added with cost and schedule typically suffering as a result.

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[73] Department of Defense, *Defense Acquisition Guidebook*, November 2004.

[74] Ibid.

[75] Lee Williams, “The Elements of Technical Requirements,” (Lecture for International Council on Systems Engineering, February 21, 2006).

[76] Dan Ward, “Modern Acquisition Myths: One Size Does Not Fit All,” *Program Management* (March-April 2003): 32.

*Requirements creep* (change in goals) is generally introduced to the Defense Acquisition System in one of three ways; overlooked requirements, changing requirements, and excessive requirements.[77] Overlooked requirements are requirements warfighters do not foresee or properly identify at the onset of an acquisition program. For example, a missile test for the Critical Measurements and Countermeasures (CMCM) program experienced a launch delay in April 2006 at Kauai, Hawaii. The holdup was caused by an overlooked requirement, which, for safety reasons, belatedly mandated adherence to a more stringent trajectory.[78] Changing requirements is exactly as it sounds, requirements get modified slightly in reaction to justifiable stimuli, like reacting to the Improvised Explosive Device (IED) threat in Iraq. Conversely, an excessive requirement occurs when warfighters over-specify or provide too many requirements that are rarely needed or provided through some other means. This sometimes happens as a result of not knowing exactly what is needed.

### 3. Evolutionary Acquisition Strategy

The Defense Acquisition System's overarching strategy to accomplish its mission, seek its vision, and satisfy its individual program goals is prescribed by Department leadership: *Evolutionary Acquisition* is the preferred approach.[79] *Evolutionary Acquisition* is a specific strategy designed to embrace the reality of Moore's Law while leveraging the most mature technologies to warfighters as fast as possible. Although evolutionary concepts had been around for decades, the DoD mandated an *Evolutionary Acquisition* strategy in October of 2000 via a DEPSEC policy letter. This revised policy

[77] Lee Williams, "The Elements of Technical Requirements," (Lecture for International Council on Systems Engineering, February 21, 2006).

[78] Michael Alexander, "Critical Measurements and Countermeasures Program," (Personal experience as Integration Program Manger for the Missile Defense Agency, April 2006).

[79] Department of Defense Directive 5000.1, *The Defense Acquisition System*, May 12, 2003.

ran counter to outdated, single-step-to-full-capability strategies, as experienced with the F/A-22 Raptor, where all the technological challenges had to be resolved prior to production and deployment.[80]

*Evolutionary Acquisition* strategy is based on two conditions that must exist prior to deployment and testing of a specified system: 1) Warfighters can utilize the system in a real world environment, and 2) The fielded aspect of the system is technologically viable.[81] In other words, *Evolutionary Acquisition* seeks to provide quick product deployments or incremental spinouts of capability to users as the technology matures. This permits programs to evolve and build on each increment deployed to the field until the original warfighter requirements are met.

Hence, it is accepted practice to field an item if some of the critical performance parameters are not satisfied with the first increment because *Evolutionary Acquisition* absorbs risk of underperformance through constant feedback and testing from warfighters performing in the battle space.[82] An example of *Evolutionary Acquisition* is demonstrated with the Navy's incremental procurement of the F/A-18E/F Super Hornet models where early deployed systems provided essential capability for the warfighter with later developments and deployment adding additional capability needed by the warfighter for other specialized missions—as technologies matured.

There are two methodologies that enable *Evolutionary Acquisition* strategy within the Defense Acquisition System: *spiral* and *incremental*. *Spiral* is the preferred methodology, according to DoD Directive 5000.1, and it means the desired capability is known by the warfighter, but the specific requirements and end state are unclear at the program's onset. Alternatively, *incremental* methodology defines the desired capability, requirements, and the end state from the outset. In the most basic sense, *spiral* methodology is an unscripted venture and *incremental* methodology is a scripted

[80] Obaid Younossi, David E. Stem, Mark A. Lorrell, and Francis M. Lussier, *Lessons Learned from the F/A-22 and F/18-E/F Development Programs* (Santa Monica: Rand Corporation, 2005).

[81] Michael Alexander and Brian Meinshausen, "Evolutionary Acquisition and its Impact on Supportability," (Lecture at the Naval Postgraduate School, October 22, 2007).

[82] Department of Defense Instruction 5000.2, *Operating the Defense Acquisition System*, May 13, 2000.

undertaking. The common theme with both of these evolutionary methodologies, however, is the Technology Readiness Level (TRL) of the fully desired capability is not mature or is unaffordable at the program's initiation, hence the need for incremental deployments and evolution.

## D. DESIGN FACTORS

*Design factors* make up key components of the Roberts *organizational systems model*, as they are also elements for which the system can mold and shape to optimize performance of the system as it interacts with inputs and the environment. The subsections below generally portray the *design factors* of the Defense Acquisition System with respect to its *Tasks, Technology, Structure, People,* and *Processes/Subsystems*.

### 1. Tasks

*Tasks* are the basic functions of an organizational system, and there are innumerable *tasks* that make up the Defense Acquisition System. Activities such as program management, systems engineering, contracting, financial management, cost estimation, test and evaluation, logistics and supportability management, modeling and simulation, documentation, software development, configuration management, strategy development, risk management, Low Rate Initial Production (LRIP), and formal reviews represent a small sampling of the myriad of *tasks* attributable to the system.

Consequently, it is only possible to generalize the primary *tasks* of the Defense Acquisition System, where all of the possible *subtasks* within the system roll up and support what DoD Instruction 5000.2 *Operation of the Defense Acquisition System* classifies as major phases of the overall system. These system phases—which this study treats as *major tasks*—are Concept Refinement, Technology Development, System Development and Demonstration (SDD), Production and Deployment, and Operations and Support. Figure 3.2 illustrates the major phases (*tasks*) of the Defense Acquisition System. Each phase's (*task's*) general description is taken via DoD Instruction 5000.2:[83]

[83] Department of Defense Instruction 5000.2, *Operating the Defense Acquisition System*, May 13, 2000.

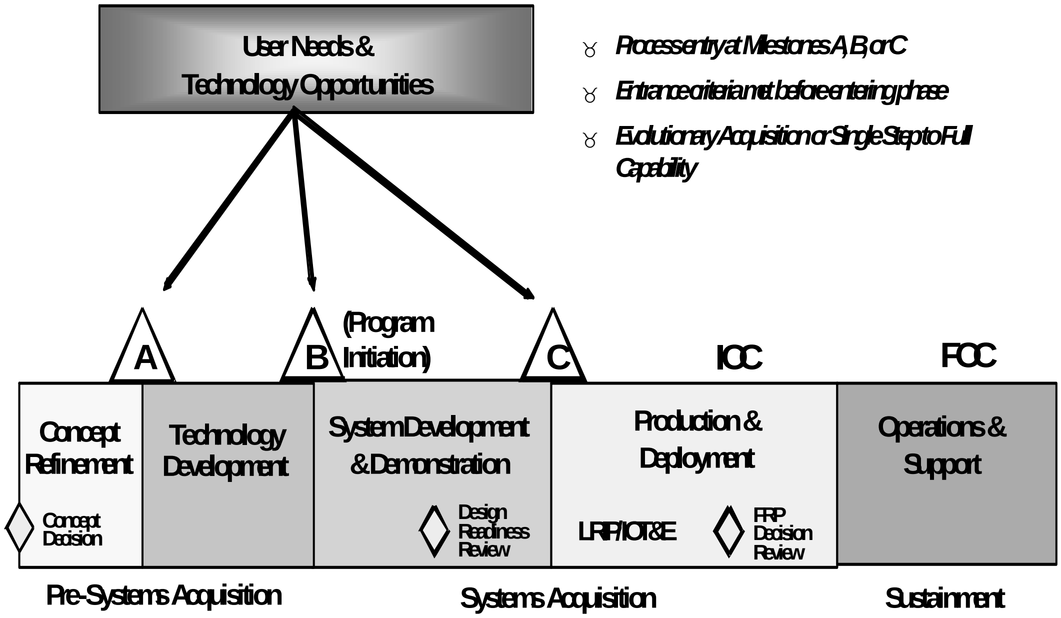


Figure 3.2. Defense Acquisition System Phases (Source: DoD Instruction 5000.2)

### *a. Concept Refinement*

*The purpose of this phase is to refine the initial concept and develop a Technology Development Strategy. Entrance into this phase depends upon an approved Initial Capabilities Document (ICD) resulting from the analysis of potential concepts across the DoD Components, international systems from Allies, and cooperative opportunities; and an approved plan for conducting an Analysis of Alternatives (AoA) for the selected concept, documented in the approved ICD.*

### *b. Technology Development*

*The purpose of this phase is to reduce technology risk and to determine the appropriate set of technologies to be integrated into a full system. Technology Development is a continuous technology discovery and development process reflecting close collaboration between the Science and Technology community, the user, and the system developer. It is an iterative process designed to assess the viability of technologies while simultaneously refining user requirements.*

#### *c. System Development and Demonstration*

*The purpose of the System Development and Demonstration Phase (SDD) phase is to develop a system or an increment of capability; reduce integration and manufacturing risk; ensure operational supportability with particular attention to reducing the logistics footprint; implement human systems integration; design for producibility; ensure affordability and the protection of critical program information by implementing appropriate techniques such as anti-tamper; and demonstrate system integration, interoperability, safety, and utility…The two key functions of SDD are System Integration and System Demonstration.*

#### *d. Production and Deployment*

*The purpose of the Production and Deployment phase is to achieve an operational capability that satisfies mission needs. Operational test and evaluation shall determine the effectiveness and suitability of the system. The MDA shall make the decision to commit the DoD to production at Milestone C. Milestone C authorizes entry into LRIP (for Major Defense Acquisition Programs and major systems), or into production or procurement (for non-major systems that do not require LRIP), or into limited deployment in support of operational testing for Major Automated Information System programs or software-intensive systems with no production components.*

#### *e. Operations and Maintenance*

*The objective of this activity is the execution of a support program that meets operational support performance requirements and sustains the system in the most cost-effective manner over its total life cycle. When the system has reached the end of its useful life, it shall be disposed of in an appropriate manner. Operations and Support has two major efforts: Sustainment and Disposal.*

### 2. Technology (Flow)

Workflows and interdependencies between *tasks* clarify what is meant by *technology* with regard to Robert's *organizational systems model*. While depicting a flow diagram with any granularity is just as unfeasible as delineating all of the acquisition

system's *tasks* and *subtasks*, Figure 3.2, at a minimum, represents a spectrum of sequential, overarching process flow within the system. Each major phase (*major task*) in the system is designed to build on the previous phase in support of a life cycle philosophy. Furthermore, the linkages between the phases by way of milestone decisions necessitate intermediate inputs and outputs within the system. DoD Instruction 5000.2 outlines the general boundaries of *technology* (flow) that make up the system.

Essentially, the Defense Acquisition System starts its flow of *tasks* with the process of defining and exploring User Needs and Technological Opportunities. Therefore, the system ensures concepts are developed in accordance with user requirements in the Concept Refinement Phase, which are further solidified at the Milestone A decision before advancing into the Technology Development phase. The completion of Technology Development is ratified with a Milestone B decision, which officially signifies the initiation of a program prior to entrance into the SDD Phase. After development and demonstration of the procurement item through a significant amount of testing and integration, Milestone C is the next major juncture. After the Milestone C decision, the procurement item, if applicable, is then ready to progress into LRIP before heading into the full-up Production and Deployment Phase of the acquisition process. Once the procurement item has been fielded, the last phase of Operations and Support kicks into high gear, which denotes Initial Operational Capability (IOC) and Full Operational Capability (FOC).

One might mostly characterize the *technology*, or major flow of *tasks* within the Defense Acquisition System, as chronologically dependent, given the sequential nature of the aforementioned. Essentially, the quality of subsequent *tasks* is typically reliant on the quality of predecessor *tasks*. This means, for example, a Technology Development Strategy (TDS) must be established prior to SDD. The Test and Evaluation Master Plan (TEMP) should be written before integration and developmental and operational testing. The Critical Design Review (CDR) shall happen before product manufacture begins. In other words, a calculated flow (*technology*) within the overall system exists as a weapon system becomes defined, refined, designed, produced, fielded, maintained, and disposed—which is illustrative of an acquisition life cycle.

While the overarching *technology* of the Defense Acquisition System is serial and geared toward a life cycle, a derivative explanation of the system's *technology* is warranted. *Tasks* and *subtasks* within the system may flow in parallel or feed backward. A good example of parallel *technology* is when a program manager plans for life cycle logistics support and integration while working the early stages of design and development. An example of when the system's *technology* feeds backward is when verification and validation of requirements or specifications occurs during a weapon system's testing and evaluation activities. It is also important to recognize that *technology* varies with each acquisition program; hence, the workflows will not only differ but overlap within the system. Furthermore, although DoD Instruction 5000.2 provides a useful template for how to construct a program's *technology* (interrelationships of *tasks* and flow), compositions of flows are customarily unique, complex, and circuitous.

### 3. Structure (Organization)

*Structure*, with respect to the Roberts *organizational systems model*, is a *design factor* that accounts for the system groupings of activities and people. In other words, it addresses how the system organizes *tasks* and *personnel*. Recall the Defense Acquisition System resides within the Defense Acquisition Framework as one of three interconnected Decision Support Systems, the other two being JCIDS and PPBE (shown in Figure 1.1).

The Defense Acquisition System's *tasks* are functionally integrated, meaning they are not isolated from various JCIDS and PPBE activities. Figure 3.3 offers a pictorial representation of the interconnectivity of the Defense Acquisition System within the Defense Acquisition Framework. *Tasks* generally flow from left to right and are grouped into phases, which were described previously. The phases are depicted with vertical lines as they interconnect with each Decision Support System within the framework. Hence, within each phase, the Defense Acquisition System's realm of responsibilities and its tasks blend with JCIDS and PPBE as programs progress through the system's life cycle.

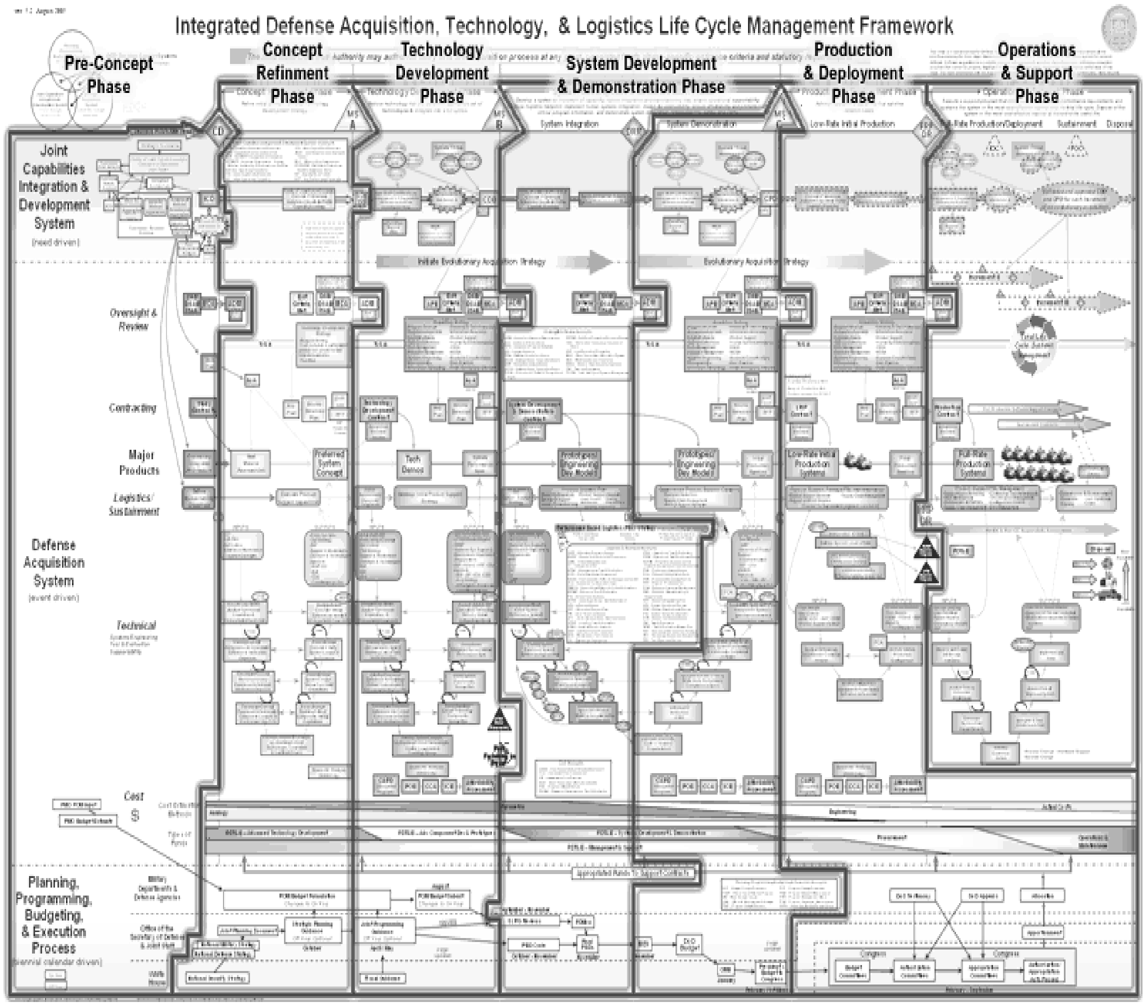


Figure 3.3. Defense Acquisition System within the Defense Acquisition Framework (Source: DoD Instruction 5000.2)

The *organizational arrangements* that contribute to the management of the Defense Acquisition System are similarly complex to its partitions and groupings of *tasks*. The system has far reaching organizational tentacles, as it applies to all acquisition programs within the Office of the Secretary of Defense, Military Departments, Chairman of the Joint Chiefs of Staff, Combatant Commands, Office of the Inspector General of the Department of Defense, Defense Agencies, DoD Field Activities, and all other DoD organizational entities.[84] For all intents and purposes, anything and everything

[84] Department of Defense Directive 5000.1, *The Defense Acquisition System*, May 13, 2003.

acquisition-related converges on the Defense Acquisition System in some form, meaning that thousands of military, DoD civilian, contractor organizations, and sub organizations participate in the Defense Acquisition System.

It is not feasible to portray an inclusive organizational chart because there is no prescriptive, formal organizational structure for the Defense Acquisition System. Recall the system is a process for which organizations control, participate, and manage individual programs. Hence, organizational *structures* vary with each program. This current framework is evidenced by the nature of the leadership position with oversight over the Defense Acquisition System. This position lies with USD (AT&L); however, this role does not grant command or authoritative power over the organizations that contribute to the system. Rather, the USD (AT&L), as a principal staff agent to the Secretary of Defense (Figure 3.4), provides policy, guidance, and instruction for the management of the Defense Acquisition System. As a result, DoD Directive 5134.1 *Under Secretary of Defense for Acquisition, Technology, and Logistics* simply promotes the establishment of acquisition lanes that remove duplication of effort and drive Department components to work together seamlessly.[85]

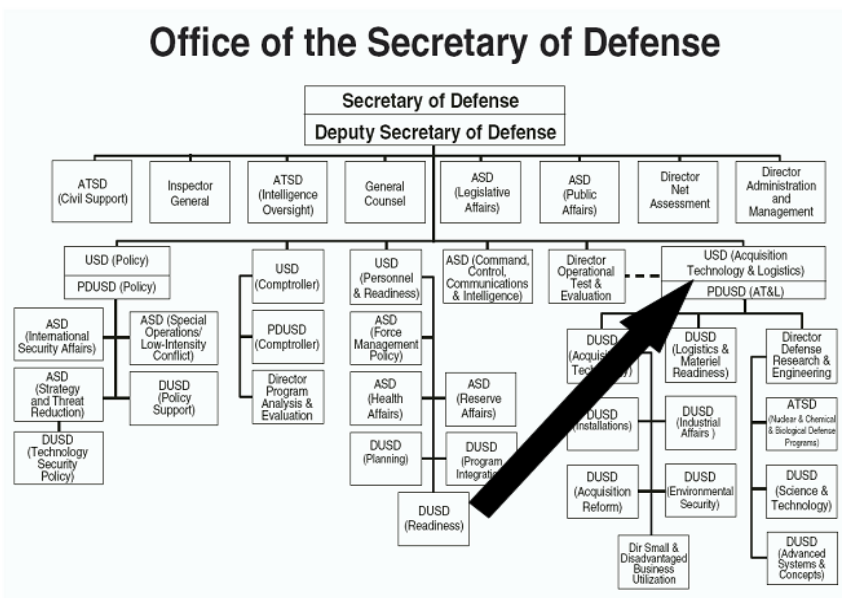


Figure 3.4. USD (AT&L) within OSD (Source: DoD, March 2001)

[85] DoD Directive 5134.1, *Under Secretary of Defense for Acquisition, Technology, and Logistics*, December 9, 2005.

Once more, there is no universally accepted construct for formulating organizations that operate within the Defense Acquisition System. This means organizations, which may be geographically separated, must develop the best ways to interact together within the system, which is frequently accomplished by way of Memorandum of Agreement (MOA). An MOA is an example of a document used to establish relationships between two or more organizations working collaboratively within the Defense Acquisition System. It customarily highlights agreements between organizations in five areas: 1) Identifies ground rules for information exchange and coordination of activities, 2) Establishes level of participation, 3) Provides points of contact or liaisons, 4) Explains roles and responsibilities, and 5) Creates horizontal, matrix organizational relationships, if necessary.[86] An example of an MOA is seen with the Missile Defense Agency's partnership with the Air Force's Space and Missile Systems Center and the Army's Space and Missile Defense Command in order to acquire and test missile systems. An MOA is sometimes referred to as a Memorandum of Understanding (MOU), but both are collateral agreements, not legally binding.

Although there is no mandated design for organizations taking part in the Defense Acquisition System, there are three organizational entities, in addition to USD (AT&L), which are principal focal points for the system: 1) ASD (C3I), 2) DOT&E, and 3) CJCS. DoD Directive 5000.1 states the offices of USD (AT&L), ASD (C3I), and DOT&E "are key officials of the Defense Acquisition System…they may jointly issue DoD Instructions, DoD Publications, and one-time directive-type memoranda, consistent with DoD 5025.1-M."[87] The directive also states, "The CJCS shall provide advice and assessment on military capability needs…and may engage components and agencies to provide this advice and assessment."[88]

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[86] "Memorandum of Agreement Between the United States Department of Defense Missile Defense Agency and the National Aeronautics Space Administration Washington D.C. for Information and Resource Sharing," September 30, 2003, http://www.hq.nasa.gov/office/codeq/doctree/moa_mda_nasa.pdf (accessed on November 24, 2007).

[87] Department of Defense Directive 5000.1, *The Defense Acquisition System*, May 13, 2003.

[88] Ibid.

In effect, the offices of USD (AT&L), ASD (C3I) and DOT&E govern the Defense Acquisition System without real dominion over the organizations operating within the system. Conversely, the CJCS largely holds positional power over most DoD organizations, yet the Defense Acquisition System is not a subordinate organization or process under the Chairman's direct control. Rather, the CJCS provides inputs to the system by way of expressing capability needs through the JCIDS Decision Support System. This arrangement of informal alliances at the highest levels of organization within the DoD sets the tone for how organizations manage and cooperate within the Defense Acquisition System at the lower levels.

In order to organize major Defense Acquisition System program management within the framework of DoD organizational hierarchies, program offices are customarily established with horizontal, matrix-type Integrated Product Teams (IPT). Program offices of single or joint origin serve as focal points for major defense programs like JSF, for example. The JSF Program Office is lead by a Program Executive Officer (PEO), which is currently an Air Force Major General, yet could be from any service. The PEO, in this case, manages the JSF program through the *major tasks* or phases of the Defense Acquisition System with the help of IPTs, which are apportioned to the JSF Program Office. In the most basic sense, an IPT is made up of personnel from diverse parent organizations that form a "multidisciplinary group of people who are collectively responsible for delivering a defined product or process."[89] There is no limit on the number of IPTs supporting a program, and there may be just a few for smaller programs, and many are needed for MDAP or MAIS programs. As an illustration, the JSF Program Office has sixteen IPTs (Figure 3.5).[90]

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[89] Department of Defense, "Integrated Product Teams" Defense Acquisition University, https://acc.dau.mil/CommunityBrowser.aspx?id=24675 (accessed on November 14, 2007).

[90] Department of Defense, "Program," Joint Strike Fighter, http://www.jsf.mil/program/prog_org.htm (accessed on November 14, 2007).

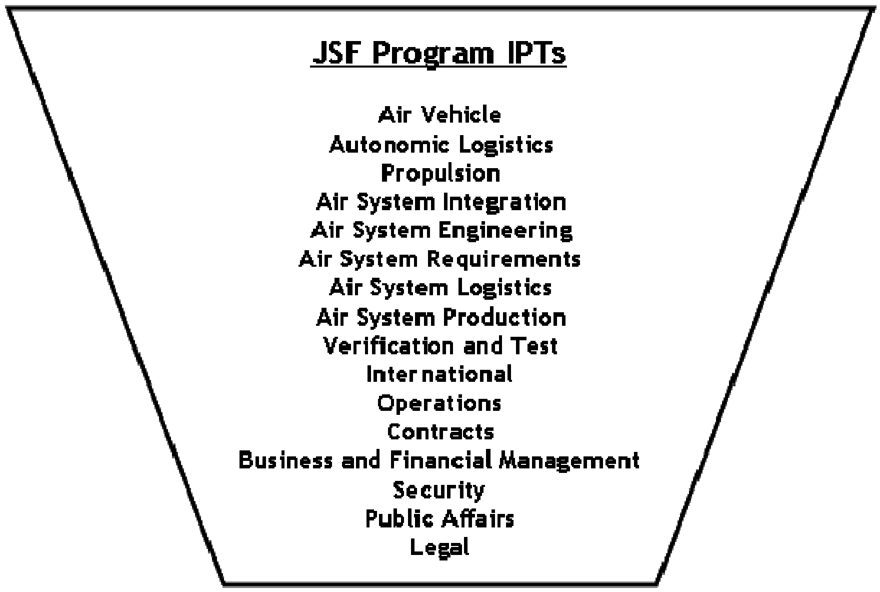


Figure 3.5. Joint Strike Fighter Program IPTs (Source: JSF Program, 2007)

#### 4. People (Workforce)

Defense Acquisition System personnel may be military, DoD civilian, or support contractor, who also participate as significant contributors to the system, but are not considered part of the Government's acquisition workforce. Nonetheless, the personnel that make up the acquisition workforce and labor force within the Defense Acquisition System are most aptly described as professional and educated. Nevertheless, this study must note the Government Accountability Office (GAO) has been critical of the knowledge, skills, and abilities of the acquisition workforce.

Generally, career-oriented Defense acquisition personnel demonstrate assorted degrees of skill, knowledge, and ability proficiency in a variety of business, engineering, and technically related fields. Examples include: Program Management; Contracting; Systems Engineering; Cost Estimating; Financial Management; Facilities Engineering; Information Technology; Life Cycle Logistics; Systems Sustainment and Management; Production, Quality, and Manufacturing; Purchasing; Systems Planning, Research, Development and Engineering; Accounting; Science & Technology Management; Test and Evaluation; and Software Development. Incidentally, as an example, the Army, Navy, and Air Force have acquisition workforces (military and DoD civilian) of 45,443,

40,651, and 25,075 respectively. Engineering disciplines represent 26 percent, 41 percent, and 25 percent of those respective acquisition workforces.[91]

There is a distinctive part of the workforce called the Acquisition Corps, which is distinguished from other military and DoD civilian counterparts. DoD Directive 5000.52 *Defense Acquisition, Technology, and Logistics Workforce Education, Training, and Career Development Program* recognizes acquisition professionals as being members of the Acquisition Corps after passing qualifications set forth in Chapter 87 of Title 10, United States Code, Subchapter III. The code levies educational and experience requirements to qualify for the Acquisition Corps: baccalaureate degree, at least 24 semester hours of higher education, at least 24 semester hours of higher education pertaining to one's career field, and promotion potential.[92] Acquisition Corps members fill Critical Acquisition Positions (CAP) identified by DoD Component Acquisition Executives (CAE), which are the most senior acquisition positions within the DoD.[93]

Much of the professionalism of the acquisition workforce is due to Defense Acquisition Workforce Improvement Act (DAWIA), which was passed in November 1990. This law mandates standards of professional development and education throughout the acquisition community and establishes education, training, and experience minimums for acquisition-critical positions.

### 5. Processes/Subsystems

Roberts encourages analysis of three areas under the *design factors* category of *processes/subsystems*: 1) *Human Resource Management*, 2) *Measurement and Controls*, and 3) *Planning, Communication, and Information Management*. The Defense Acquisition System has copious processes and subsystems, which, again, are impossible

[91] Department of Defense, "Defense Acquisition Structures and Capabilities Review," Defense Acquisition University, June 2007, http://www.dau.mil/Spotlight/doc/Final%20Final%20Report.pdf (accessed on November 24, 2007).

[92] Chapter 87 of Title 10, United States Code, Subchapter III, Section 1732, Selection Criteria and Procedures.

[93] Department of Defense Directive 5000.52, *Defense Acquisition, Technology, and Logistics Workforce Education, Training, and Career Development Program*, January 12, 2005.

to enumerate here, that assist with managing the overall system. Even so, the following identifies some of the major processes and subsystems relevant to this analysis of the Defense Acquisition System.

#### *a. Human Resource Management*

Defense Acquisition University (DAU) is the training hub for Defense Acquisition System organizations and personnel. DAU publishes the "horse blanket," which is a two feet by three feet wall chart that illustrates the Decision Support Systems and their interrelationships between phases of the Defense Acquisition Framework (Figure 3.3).[94] The mission of DAU is to "provide practitioner training, career management, and services to enable the Acquisition, Technology, and Logistics community to make smart business decisions and deliver timely and affordable capabilities to the warfighter."[95]

Basically, DAU gears its education toward the professional development of the DoD civilian and military acquisition workforce. DAU received accreditation from the Council of Occupational Education in February 2003 and is able to provide certifications to the acquisition workforce for various acquisition disciplines. Such certifications are important for meeting DAWIA training requirements and promotion and job qualifications, i.e., Acquisition Corps, within the Defense Acquisition System.

#### *b. Controls and Measurements*

Many of the *controls and measurements* of the Defense Acquisition System come in the form of regulations, directives, instructions, and guidance. Some of the policy-driven controls have been mentioned; however, the system is also governed by the guidance provided in the FAR, which, according to FAR Subpart 1.101 is "established for the codification and publication of uniform policies and procedures for

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[94] Marshall Engelbeck, "MN3331 Principles of Acquisition Management," (Lecture at the Naval Postgraduate School, Monterey, California, 1st Quarter, 2007).

[95] Department of Defense, "DAU's Mission and Vision," Defense Acquisition University, http://www.dau.mil/about-dau/docs/mission_vision.ppt (accessed on November 15, 2007).

acquisition by all executive agencies."[96] The FAR's guidance is further refined through the Defense Federal Acquisition Regulation Supplement (DFARS), which is tailored to unique DoD requirements. Moreover, the Armed Services, agencies, and elements of the DoD have various acquisition-related supplements with ever more directive control. Armed Services examples include Army Regulation (AR) 70-1 *Army Acquisition Policy*, Department of Army Pamphlet (DA PAM) 70-3 *Army Acquisition Procedures*, Secretary of the Navy Instruction (SECNAVINST) 5000.2C *Implementation and Operation of the Defense Acquisition System and the Joint Capabilities and Integration and Development System*, and Air Force Instruction (AFI) 63-101 *Acquisition System*.

Other examples of *controls and measures* for the system are milestone decisions, formal reviews, and program baselines. Milestone decisions are integral control points that ensure programs are ready to progress to the next phase, e.g., from Technology Development to SDD with a Milestone B decision. Formal reviews like the CDR, provide assurance that procurement design is complete and will likely result in construction of a suitable system prior to fabrication and integration of subcomponents. Also, at a broad level, program baselines such as the APB establish cost, schedule, and performance goals that help measure a program's progress through the system's life cycle. Lastly, Earned Value Management (EVM) is a common subsystem that helps track cost and schedule status of system programs.

#### *c. Planning, Communication, and Information Management*

There is no formal *planning, communication, and information management* mechanism for the Defense Acquisition System. Rather, leaders encourage the use of "Best Practices."[97] Each program and its supporting organizations have the autonomy to decide how to best plan, communicate, and manage information within the confines of the laws, policies, and guidance governing the system. Often times planning, communication, and information management methodologies are determined by the PEO or PM in concert with the Milestone Decision Authority (MDA), acquisition leadership

[96] Federal Acquisition Regulation, Subpart 1.101.

[97] Department of Defense, *Defense Acquisition Guidebook*, November 2004.

and within established norms of the acquisition workforce. There are key planning documents such as the Acquisition Strategy, Test and Evaluation Strategy, Systems Engineering Plan (SEP), Test and Evaluation Master Plan (TEMP), Risk Management Plan, and many others that document and assist with planning, but even the constructs of these documents vary from program to program.

Lastly, there are a multitude of software programs available to help manage acquisition system information, aside from traditional Microsoft Office functions used throughout the DoD. One example is the Comprehensive Cost and Requirements System (CCaRS), which is a program used by some Air Force organizations to manage funding documents, budgets, contracting documents, and requirements. CCaRS is one of countless non-standardized information management tools used within the Defense Acquisition System.

## E. CULTURE

*Culture* is one of the manifestations of the Defense Acquisition System that is difficult to adequately define, as the system's *culture* is part of DoD *culture*—and the possibilities are endless. Roberts urges an evaluation of norms, values, conflict management, and patterns of interaction, but it is impractical to provide a line-by-line assessment of these areas, mostly because the system encompasses too many variables for the scope of this holistic study. However, there are aspects of *culture* useful for analysis, both with negative and positive connotations.

The GAO defines the culture of the Defense Acquisition System as being "the collective behavior of the various participants in the acquisition process and the forces that motivate their behavior."[98] The GAO cites cultural norms such as parochialism, undo optimism, and stick-to-itiveness as being unconstructive.[99] Parochialism refers to prisoner's dilemma manifestations through lack of trust and interest in self-

[98] Louis J. Rodrigues, "Defense Acquisition Organizations: Linking Workforce Reductions with Better Program Outcomes," General Accountability Office, April 8, 1997.

[99] Ibid.

preservation.[100] In other words, DoD chains of command represent a large, bureaucratic landscape, which is ripe for agenda setting.[101] Undo optimism refers to the tendency of system players to collectively and unreasonably forecast assurances of cost, schedule, and performance without a basis in realism. Stick-to-itiveness refers to the propensity to stay the course with acquisition programs despite causal evidence to cancel such programs, i.e., some say the V-22 Osprey. On the other hand, there are positive cultural aspects of the system too. A *culture* of teaming, collaboration, integrity, loyalty, and dedication of well-intentioned professionals permeates the Defense Acquisition System.

## F. OUTPUTS

The outputs of the Defense Acquisition System result from acquisition programs that proceed through the system, which take the form of products or services that are delivered in support of America's defense, referred to in this study as warfighters. Outputs of the system can be almost anything supporting warfighter missions. Examples include aircraft for the Air Force, tanks for the Army, software-intensive databases for the Navy's personnel system, intelligence gathering satellites, or food and housing services for troops serving in Iraq and Afghanistan. The outputs of the system are generally measured in accordance with cost, schedule, and performance metrics (goals).

## G. OUTCOMES (INTENDED AND UNINTENDED)

Recall the Roberts *organizational systems model* speaks to *outcomes* as the consequences of *outputs*, which are interpreted relative to the system's environment (Figure 3.6). For simplicity, this research classifies *outcomes* as two basic types: intended or unintended. Intended outcomes are positive results that stem from the system. In the case of the Defense Acquisition System, there are numerous positive, intended outcomes that are indisputable. For example, the system supplied capability that significantly contributed to winning the Cold War with the Soviet Union by providing advanced

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[100] Peter Coughlan, "GB4014 Strategic Management," (Lecture at the Naval Postgraduate School, Monterey, California, 3rd Quarter, 2007).

[101] Brooks Bash, "Leadership and Parochialism: An Enduring Reality?" *Joint Forces Quarterly* (Summer 1999): 64.

weapons capability for National Defense. Also, in practical terms, America currently has the most advanced military "the history of the world has ever seen," and much of it is due to the mission platforms provided by the Defense Acquisition Systems.[102] Indeed, the system yields good, intended outcomes.

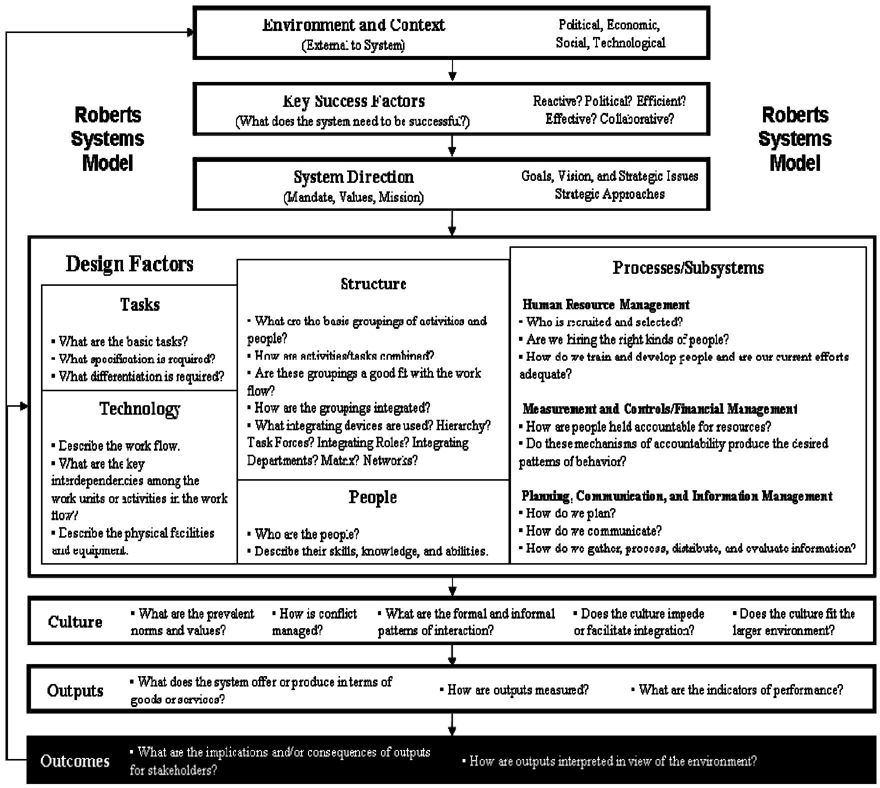


Figure 3.6. Roberts Model Outcomes (Source: Bruner, 1998)

Conversely, bad, unintended outcomes are results for which the system does not desire. For example, *cost overruns*, *schedule delays*, and *poor performance* are precisely the outcomes the Defense Acquisition System intends to avoid.[103] Accordingly, it is worthwhile to take a moment and briefly elaborate on these particular unintended

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[102] Cary Simon, "GB3010 Managing for Organizational Effectiveness," (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

[103] Marshall Engelbeck, "MN3331 Principles of Acquisition Management," (Lecture at the Naval Postgraduate School, Monterey, California, 1st Quarter, 2007).

outcomes—especially since the acquisition system is routinely stigmatized for its repeated shortfalls in metric areas of cost, schedule, and performance.

### 1. Cost Overruns

The Defense Acquisition System has experienced difficulty with accurately projecting costs. For example, the Space Based Infrared Radar System (SIBRS), which has been in development since 1996 and is intended to provide next generation missile early warning and detection capabilities, has experience innumerable cost overruns since its inception—in excess of billions of dollars, and, in some cases, over 100 percent of predicted cost.[104] On average, according to a study done nearly twenty years ago, DoD acquirers paid a forty percent premium for weapons procurements, which means the Government doled out $400 million extra for a $1 billion program.[105] Unfortunately, there are signs the trend is getting worse in the current era where Government Accountability Office reports suggest cost overrun percentages are averaging as high as 50 percent—which might even be a conservative figure given the performance of programs like SIBRS.[106]

Furthermore, evidence shows contractors routinely do not recover from cost overruns once they exceed their projections, especially late in a program's acquisition cycle. Once a contractor busts its budget, it is almost impossible to restore the financial plan back to its original baseline, especially if the contractor has surpassed the fifteen percent completion point of the contract.[107] In other words, the further one progresses through the Defense Acquisition System, the more difficult it is to recover from cost overruns. A noted example of a cost overrun outcome is with the Navy's LCS

[104] Cristina Chaplain, "Space Acquisitions: Actions Needed to Expand and Sustain Use of Best Practices," (Government Accountability Office testimony before Subcommittee on Strategic Forces, Senate Committee on Armed Services, April 2007).

[105] Jaques Gansler, *Affording Defense* (Cambridge, Massachusetts: MIT Press, 1989).

[106] Katherine Schinasi, "DoD Acquisition Outcomes: A Case for Change," (Government Accountability Office testimony before the Subcommittee on Air and Land, Senate Committee on Armed Services, November 2005).

[107] John Pletcher and Jane Young, "An Evaluation of Department of Defense Contractors' Cost Performance," (Masters thesis, Air Force Institute of Technology, September 1994).

procurement. Lockheed Martin was not quite 75 percent complete with the construction of LCS-3, but estimates revealed cost overruns as high as $100 million for this vessel, which was supposed to cost approximately $220 million.[108] According to the trend, from a cost perspective, LCS-3 would have never gotten back on track. In fact, it did not because the Navy recently cancelled the contract with Lockheed Martin, as stated earlier.

### 2. Schedule Delays

For major Defense programs, Defense Acquisition System cycle times, on average, are approximately ten years, and, in the worst cases, procurements have taken upwards of 25 years to initially field a new weapon system for America's warfighters.[109] To revisit an example, one of the DoD's most frequently touted schedule delay cases is the acquisition of the F/A-22 Raptor. The F/A-22 is a state-of-the-art weapon system, which was originally conceived in 1981 and has just recently entered service, 26 years after conception. The Raptor is currently populating the flight lines of the Air Force, as it is still in the Production and Deployment Phase; yet, it is an acquisition that is ebbing close to three decades. Albeit, the Air Force is currently fielding one of the most advanced fighters in the world, which is an intended outcome; however, some argue the timing of F/A-22 delivery is way too late, especially given the nature of an evolving manner of warfare under GWOT, an *environmental context* discussed previously.

### 3. Poor Performance

Poor Performance is another unintended outcome of the Defense Acquisition System. The Defense Travel System (DTS), for example, was designed to facilitate the travel orders and approval process, thereby automating scheduling of flights, hotels, and rental cars—similar in function to Expedia.com. When DTS was first introduced to the field, it did not live up to expectations, as the initial fielding of the system caused major

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[108] Christopher Cavas, "LCS Cost Growth Extends to GD Ship, Navy Official Says," *Defensenews.com*, March 2, 2007, http://defensenews.com/story.php?F=2594497&C=navwar, (accessed on November 24, 2007).

[109] Chuck Paone, "Acquisition Chief Discusses Transformation," *Air Force News Service*, December 5, 2002, http://www.dau.mil/pubs/pm/pmpdf03/airjf03.pdf (accessed on November 24, 2007).

problems for users that had to use it.[110] There were bugs in the software, travel order approval and coordination loops had not been ironed out, and customers did not receive travel reimbursement for weeks.

One more example of poor performance was seen with the deployment of the Theater Battle Management Core System (TBMCS) during the onset of Operation Enduring Freedom (OEF) in October 2001.[111] TBMCS was a software-based operating system designed to help coordinate command and control activities between joint planners and operators during OEF wartime activities. One of the many TBMCS applications was intended to help keep track of targeting data. However, users quickly learned that the targeting application embedded in the Unix-based TBMCS operating system was not compatible with a targeting officer’s day-to-day mission needs. Consequently, targeteers had to default to using Windows-based Excel spreadsheets to keep track of their targets, which was not ideal given that Excel is not a database tool. TBMCS, in a real wartime environment, was rendered useless to the targeting community—an unintended outcome of the Defense Acquisition System.

[110] Michael Alexander, (Personal experience as user of the Defense Travel System, June 2003-2006).

[111] Michael Alexander, (Personal experience as Targeting Officer, October 2001 – December 2001).

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# IV. CONCLUSIONS AND RECOMMENDATIONS

This final chapter presents conclusions based on theoretical tools and analysis respectively presented in Chapters II and III. In particular, conclusions are drawn from the holistic relationships between the following: Defense Acquisition System; systems theory; organizational approaches and configurations; and the Roberts *organizational systems model*. This chapter also proffers recommendations for system improvement, intended for leaders, i.e., USD (AT&L), with influential power over the system.

## A. A FIT OF LOW EFFICIENCY AND MEDIUM EFFECTIVENESS

**Conclusion: The greater Defense Acquisition System appears to resemble a construct marked by low efficiency and medium effectiveness, befitting that of a firefighter and, at times, a champion of innovation.** Revisiting Roberts' four approaches to public sector management helps because the Defense Acquisition System fits a mostly *responsive* and somewhat *adaptive* profile (Figure 4.1). This characterization represents a natural system tendency, which is not meant to pass judgment; rather, it merely provides a fit for which subsequent system configurations should be consistent and harmonious.[112]

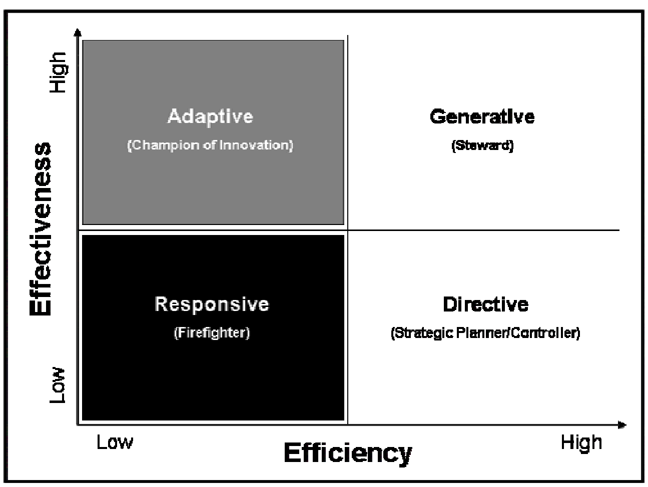


Figure 4.1. Character of the Defense Acquisition System (Source: Roberts, 2001)

[112] Henry Mintzberg, "Organization Design: Fashion or Fit?" *Harvard Business Review* Vol. 59 No. 1 (January-February 1981): 103.

The system is mostly *responsive* (low efficiency) for a number of reasons. The system interacts with an enormously complex machine bureaucracy within an unstable *environmental context*, which contributes to low efficiency. Political influences, budget constraints, changing threats, technological advances, commercial and economic influences, and societal pressures impact, what under perfect circumstances, might become an efficient acquisition system. Particularly, potent political forces and increasingly constrained resources force the system's stakeholders to compete and respond in a parochial fashion. Stakeholders are also enabled to compete and broker for power within the Defense Acquisition System's construct due to the lack of rigidity in organizational *structures*. Also, repeated, unintended system *outcomes* of cost overruns and schedule delays point to low efficiency. Lastly, one of the five policies (*key success factors*) in DoD Directive 5000.1 *The Defense Acquisition System* is "Responsiveness."

An objective examination suggests the system is also moderately *adaptive* (medium effectiveness), partly due to the formation of organizational adhocracies, embraced flexibility, and indisputable effectiveness of some of the system's products and services.[113] The use of IPTs or matrix organizations creates ad hoc relationships that support acquisition programs. "Flexibility" is also encouraged as a system governing policy in DoD 5000.1. Therefore, many attributes of the system lean toward low efficiency—but in the *adaptive* realm as well. This research must also acknowledge the big-picture effectiveness of the Defense Acquisition System's products and services that support America's warfighters, i.e., aircraft, ships, tanks, and satellites, which further pushes the system up into the moderately effective—or *adaptive* realm.

**Recommendation: The Office of USD (AT&L) should acknowledge that the Defense Acquisition System is mostly *responsive*, sharpen firefighting skills, and commence further study on the system's questionable *adaptive* effects, as they might be strikingly detrimental to the system due to a lack of a natural fit.** The factors that force the system to be *responsive* are primarily products of its *environmental context*—and therefore uncontrollable and necesssary. Unless the Federal Government undergoes a

[113] Nancy C. Roberts, "Organizational Configurations: Four Approaches to Public Sector Management," in *Advancing Public Management: New Developments in Theory Methods and Practice*, ed. Jeffrey Brudney, Laurence (Washington D.C.: Georgetown University Press, 2001), 223.

major restructuring that rids a *culture* of parochialism, continued development of power brokerage and crisis management skills are indispensable.[114] Also, recall there are trade-offs between efficiency and effectiveness, where doing more of one may affect the other, and vice versa. Evidence shows unwarranted attempts at hybrids of efficiency and effectiveness when an organizational system is ill-fitted may cause poorer performance of the system in at least one of those areas.[115]

Therefore, it is possible that current efficiency levels, which are supposed to be low due to its *responsive* character, are even lower or worse than necessary. Consequently, *adaptive* approaches such as flexibility, collaboration, non-standardization, and decentralized organizational strategies merit a closer look with regard to the true effects on the system. The end result might mean picking a workable approach instead of trying to do too much, i.e., sticking with what is best for the system to thrive, i.e., more *directive* management approaches to offset mismatched *adaptive* philosophies. Note this potential mismatch in system fit accordingly affects the rest of the conclusions and recommendations.

## B. KEY SUCCESS FACTORS OR FAILURE FACTORS

**Conclusion: The majority of the 34 policies (*key success factors*) are likely untenable within the current set-up of the Defense Acquisition System.** The GAO stated in a November 2006 report, "The DoD’s current approach to managing service acquisition has tended to be reactive and has not fully addressed the key factors for success at either the strategic or transactional level." Parenthetically, it is worth stating that being reactive is not necessarily a bad thing (discussed above); rather, it is an inevitability and part of the true character of the Defense Acquisition System.

However, the GAO may be right about *key success factors*. Acquisition leaders may not have adequately understood the true *key success factors* of the system, leading to

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114 Nancy C. Roberts, "Organizational Configurations: Four Approaches to Public Sector Management,” in *Advancing Public Management: New Developments in Theory Methods and Practice*, ed. Jeffrey Brudney, Laurence (Washington D.C.: Georgetown University Press, 2001), 223.

115 Cary Simon, “GB3010 Managing for Organizational Effectiveness,” (Lecture at the Naval Postgraduate School, Monterey, California, 4th Quarter, 2006).

the tendency for continual acquisition reforms. From a systems analysis standpoint, some of the *key success factors* seem incongruent and do not fit, relevant to other system components, revealed through the Roberts *organizational systems model*. This research presumes 34 *key success factors* from DoD Directive 5000.1, five primary and 29 additional. Given the tendency of the system to be lowly efficient and moderately effective, and its interrelationships with a constraining *environmental context* and parochial *culture*, fulfilling all of the 34 *key success factors* is perhaps unrealistic.

For example, *key success factors* like Flexibility, Streamlined and Effective Management, Interoperability, Collaboration, and Streamlined Organizations appear to be in contravention of a DoD organizational construct indicative of centralized power and its resulting normative behaviors—despite the embracement of matrix-type IPTs. For example, members on IPTs come together under the guise of being "jointly" interconnected through "horizontal matrixing," but are beholden to parent organizations, which, in many cases, are from different Armed Services and have juxtaposed goals.[116]

Despite this organizational and cultural reality, many of the system's existing *key success factors* presuppose DoD personnel and organizations will voluntarily collaborate without allegiance to umbilical ties. Moreover, when coupling potentially contrived *key success factors* with ambiguous *system direction* like "use of best practices" and "achievement of best value," *technology* (flow) within the system almost certainly suffers due to the inconsistency and vagaries of common practices within the system that may require more rigidity.[117] Hence, the very policies promulgated by USD (AT&L) might be more damaging than helpful to the system.

**Recommendation: The Office of USD (AT&L) should revisit all 34 policies (*key success factors*) of the Defense Acquisition System to ensure proper fit with *environmental context* and *culture*, as well as understand the impact of *key success factors* on system *technology* (flow).** The *environmental context* is significantly out of DoD's control. *Culture*, on the other hand, is more changeable, but it is highly

[116] Bruce Barkley, Sr., *Integrated Project Management* (New York: McGraw Hill Company, 2006), 5.

[117] David M. Walker, "Best Practices: Better Acquisition Outcomes are Possible if DoD Can Apply Lessons Learned from F/A-22 Program," General Accountability Office, April 11, 2003.

implausible for the USD (AT&L) to shape a new *culture* because of a lack of real, authoritative power over the DoD organizations and personnel participating in the Defense Acquisition System. Consequently, USD (AT&L) may need to change *key success factors* in accordance with the system's true context (fit), focusing on what the system must do to be successful relative to its constraints.

The answers likely do not lie with the current 34 *key success factors*. In a report provided to the Senate Armed Services Subcommittee on Readiness and Management Support, the GAO claims attempts at flexibility—a current system *key success factor*—have proven painful and have vilified the ill-fitted acquisition system.[118] As a minimum, trade-off studies between the extremes of flexibility and inflexibility policies or efficiency and effectiveness initiatives are worth a finer critical analysis to better understand their effects on the system's *technology* (flow). Indeed, principles from the Roberts *organizational systems model* underscore the proper fitting of *key success factors* and implementation of commensurate *design factors*, which may yield a better opportunity to attain intended cost, schedule, and performance *outcomes* for the Defense Acquisition System's programs.

### C. FEEDBACK AND A FORMAL MECHANISM FOR LEARNING

**Conclusion: The Defense Acquisition System appears to demonstrate the inability to adequately interpret feedback and/or apply learning.** One of the major reasons for this assessment is the existence of well-documented examples of repeated, *unintended outcomes* of the system: cost overruns, schedule delays, and poor performance. The fundamental premise of *feedback* is the system's self-assessment of how well it is functioning. If feedback is positive, the system knows to maintain its course. If feedback is negative, the system must adapt and make adjustments to better shape the system's outcomes.

The Defense Acquisition System habitually receives negative feedback in the form of criticisms from the GAO, media, and even warfighters. Yet, the system continues

[118] Government Accountability Office, "Defense Acquisitions: Tailored Approach Needed to Improve Service Acquisition Outcomes." (Report to the Subcommittee on Readiness and Management Support, Senate Committee on Armed Services, November 2006).

to implement the **same mistakes** again and again**.** If the system were adequately interpreting feedback and learning from its shortfalls, one would expect to see a trend toward improvement in program metrics of cost, schedule, and performance—or at least see different mistakes surface. However, this does not appear to be the case, especially with MDAP and MAIS acquisition programs.

This research analyzes three possible causes of learning shortfalls in the system. One potential contributor originates with the lack of fit between the real character of the system and USD (AT&L) policies of unstructured collaboration, teaming, and many of the other *key success factors* discussed previously. In other words, best practices and flexible methodologies of doing business might be valuable and sustainable, only if the system learns and applies lessons. If the system is incapable or formal mechanisms are not in place to interpret feedback and apply lessons learned, it will likely continue to perform really inefficiently, indefinitely.

Ironically, another possible culprit that might compound learning issues is the individual training provided by DAU, the system's education hub. DAU offers top-notch courses for Defense Acquisition System disciplines such as contracting, program management, and logistics; however, DAU may be reinforcing the very qualities, i.e., *key success factors*, counterproductive to the system's success.

Finally, another possible reason for the system's lack of learning is due to the absence of a formal, mandated, and structured *subsystem* to filter and interpret feedback and lessons learned. It is true that DAU's AT&L Knowledge Sharing System (AKSS) is a "one stop source for AT&L information," but it is simply a repository of policies, documents, reports, briefings, regulations, and a number of other pieces of information.[119] AKSS is a fantastic Defense Acquisition System resource, but individual programs are not mandated to draw from it, as it is merely a website in space.

**Recommendation: The Office of USD (AT&L) should officially engender a learning system by going beyond the abstract guidance of "lessons learned" and "best practices," thereby establishing a formal, mandated learning mechanism for**

[119] Department of Defense, "AT&L Knowledge Sharing System," Defense Acquisition University, https://akss.dau.mil/default.aspx (accessed on November 24, 2007).

**the Defense Acquisition System.** The superseded DoD Directive 5000.1 *The Defense Acquisition System*, dated October 23, 2000, used to reference a policy that said, “Decision makers at all levels shall encourage and facilitate the documentation and institutionalization of lessons learned—both good and bad—from past experience.”[120] The dated acquisition policy also went on to state, “Decision makers at all levels should encourage a culture friendly to the documentation of valuable lessons learned and the sharing of knowledge.”[121] The current DoD Directive 5000.1 *The Defense Acquisition System*, dated May 13, 2003, has no such language.

Regardless of whether abstract policies exist, simply encouraging learning may not be good enough. The system likely requires a stronger tact; recall the discussion on fit. Thus, a formally sanctioned mechanism—possibly a new organization or an officially sanctioned piggy back off of DAU's AKSS—should be responsible for collecting, filtering, and interpreting system feedback. Acquisition programs should then be required to incorporate the specific lessons learned from this new mechanism wherever possible, and formally document their compliances. A set up like this may not be perfect, but it might dramatically improve the capability of the system, as a whole, to learn from its mistakes and capitalize on its strengths. This initiative would at least give PMs and IPTs more consistency and continuity beyond the general guidance 5000 series documents and the *Defense Acquisition Guidebook*.

## D. VARIABILITY OF INPUTS AND COPING

**Conclusion: Chronic patterns of input variability seem to pervade the system, which likely cause *technology* (flow) issues and make the Defense Acquisition System less efficient than it needs to be.** Variability simply means, “Characterized by variations.”[122] This notion of variability is crucial because it is anathema to systems, in general. Input variability or randomness, for example, directly

[120] Department of Defense Directive 5000.1, *The Defense Acquisition System*, October 23, 2000.

[121] Department of Defense Directive 5000.1, *The Defense Acquisition System*, October 23, 2000.

[122] Merriam-Webster Online, “Variability,” http://www.m-w.com/dictionary/variability (accessed on November 18, 2007).

contributes to schedule delays and indirectly degrades reliability of systems over time.[123] This is why, for instance, one witnesses stoplights at freeway onramps. Stoplights stimulate consistency and facilitate better flow of traffic and allow the freeway system to adapt and create dependable flow patterns, thereby avoiding jams.[124] Unfortunately, the Defense Acquisition System, as a whole, most probably experiences a similar phenomenon, where the reverse effect occurs: very little consistency in inputs that foster flow (*technology*) bottlenecks within the system. There are numerous culprits that cause variability. Many stem from the usual suspects of the system's *environmental context* like political forces, budget constraints, and changing threats. These causes of variability are pretty much out of the system's control. Hence, the system chooses to and must deal with irrepressible variability by being *responsive* (Figure 4.1).

It appears there are two primary sources of input variability the Defense Acquisition System attempts to more readily shape and influence, however, specifically *technological advances* and *goal (requirement) changes*. Inconsistent incorporation of technological advances can hurt the Defense Acquisition System's performance. For example, the F/A-22 Raptor program, partly due to its avoidance of an Evolutionary Acquisition strategy, had to accommodate vital technological changes throughout the life of the program, which caused major delays in schedule and increased costs. *Technological advances*, as helpful as they are in providing enhanced battle space capability, trigger change and add complexity—particularly with software-intensive programs—thereby increasing variability due to ad hoc assimilation.

*Goal (requirement) changes* are another source of input variability. In a February 2006 briefing sponsored by the International Council on Systems Engineering, "Requirements Creep" was labeled as "a landmine…and historically the number one program killer!"[125] Without a doubt, one of the major challenges affecting the entire

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[123] Keebom Kang, "GB4410 Logistics Engineering," (Lecture at the Naval Postgraduate School, 4th Quarter, 2007).

[124] Keebom Kang, "GB4410 Logistics Engineering," (Lecture at the Naval Postgraduate School, 4th Quarter, 2007).

[125] Lee Williams, "The Elements of Technical Requirements," (Lecture for International Council on Systems Engineering, February 21, 2006).

Defense Acquisition System is constant re-clarification and massaging of goals (requirements) within each of its programs. Solidifying requirements early on in a program is crucial. However, this rarely happens effectively, as the necessary restraint with the management and containment of requirements gives way to acquiescence and permits late changes to system designs, which are especially damaging late in development cycles.[126] *Requirements creep* generally leads to schedule delays and cost overruns, for which the Defense Acquisition System is stigmatized.

**Recommendation: The Office of USD (AT&L) should continue to embrace *Evolutionary Acquisition* as a preferred strategy to counteract the effects of *requirement (goal)* and *technological advancement* input variability while looking for ways to build in a repeatable process consistency across all programs.** *Evolutionary Acquisition* appears to be the best available strategy to balance the technology and requirements challenges discussed earlier. However, much like the open nature of the Defense Acquisition System, Evolutionary Acquisition concepts are extremely broad and abstract, meaning processes and standards differ from program to program. This situation runs counter to one of Mintzberg's five mechanisms for coordinating activities within an organization: *Standardization of Work Processes*.[127]

*Evolutionary Acquisition* methodologies should be clearer and more repeatable to reduce variability of the processes that assimilate requirements and technology, i.e., task specificity across system programs as well as consistency in program management subsystems, i.e., software program management tools. Furthermore, given the need for requirements development and consistency discussed earlier, the *incremental methodology* appears to be far superior to the *spiral methodology*, as the latter method's uncertainty fuels inconsistent management techniques. Lastly, refined and unswerving practices of *Evolutionary Acquisition* might materialize via a previously proposed, formal learning mechanism.

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[126] Lee Williams, "The Elements of Technical Requirements," (Lecture for International Council on Systems Engineering, February 21, 2006).

[127] Henry Mintzberg, *Mintzberg on Management: Inside Our Strange World of Organizations* (New York: The Free Press, 1989), 104.

## E. SPECIFICATION AND DIFFERENTIATION OF TASKS

**Conclusion: *Task* ambiguity, specifically with differentiation, is a possible source of ill-warranted redundancy within the Defense Acquisition System.** The Roberts *organizational systems model* urges analysis of task specification and differentiation, and it appears that many *tasks* and terms within the system are confusing and redundant, which likely cause much disorder for personnel and organizations within the system. For example, what is the difference between program management and risk management, system engineering and integration, spiral and incremental methodologies, operational assessment and OT&E, or effectiveness and suitability?

Indeed, most Defense Acquisition System *tasks* are specified in guidance documents—or made up elsewhere—where one can locate rudimentary descriptions and explanations of *tasks*, e.g., program management, risk management, integrated scheduling, operational testing, and exit criteria development for a CDR. Hence, one might claim tasks are at least specified, on a technicality. However, it is hard to argue against the fact that many of the acquisition system's tasks and terms are not differentiated from one another, as many program management tasks involve risk management tasks, for example. This most assuredly results in a tremendous amount of uncertainty and ambiguity, which possibly forces unnecessary rework and redundancy on the part of conscientious system participants.

**Recommendation: The Office of USD (AT&L), or a newly formed formal learning mechanism, should commission a thorough scrub of all the specified tasks relevant to the Defense Acquisition System and ensure they are prudently differentiated and mandated wherever possible.**

## F. FINAL ASSESSMENT

A decade old article in *Acquisition Review Quarterly* exclaims, “It is clear that simplistic, quick-fix approaches or re-circulating old ideas under new labels will not suffice," This sentiment underscores the need for a systems approach to improvement of

the Defense Acquisition System:[128] Reformers must proceed with caution because this study reveals arbitrary fixes may do more damage to the system than good, especially if so-called improvements do not account for the congruence of the interrelationships of the system as well as the system's fit within its *environmental context*.

Certainly, the Defense Acquisition System is mostly inefficient and partially ineffective, but that is its character—and that is okay. It is what it is. At its core, the system eventually provides expensive, highly sophisticated equipment and services to America’s warfighters in a constrained environment and parochial culture. Unquestionably, there is room for improvement, but expectations of the system must be realistic and in accordance with sound systematic principles.

It could take decades for the Defense Acquisition System to become *generative* (Figure 4.1), if at all, because there are so many dependent complexities and variables. Certainly, new challenges on the horizon will affect the Defense Acquisition System. For example, one of the popular leadership visions circulating throughout the DoD is to actualize a “System of Systems” philosophy Department wide in order to mitigate replication, enable integrated network communication, and, ultimately, realize cost savings.[129] Such a grand plan opens an even broader and more complicated menu of interconnections for a system that is likely ill-equipped under its current construct.

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[128] Mark Nissen, Keith Snider, and David Lamm, “Managing Radical Change in Acquisition,” *Acquisition Review Quarterly* (Spring 1998): 92.

[129] United States Joint Forces Command, “Command Mission and Priorities,” http://www.jfcom.mil (accessed on November 24, 2007).

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